

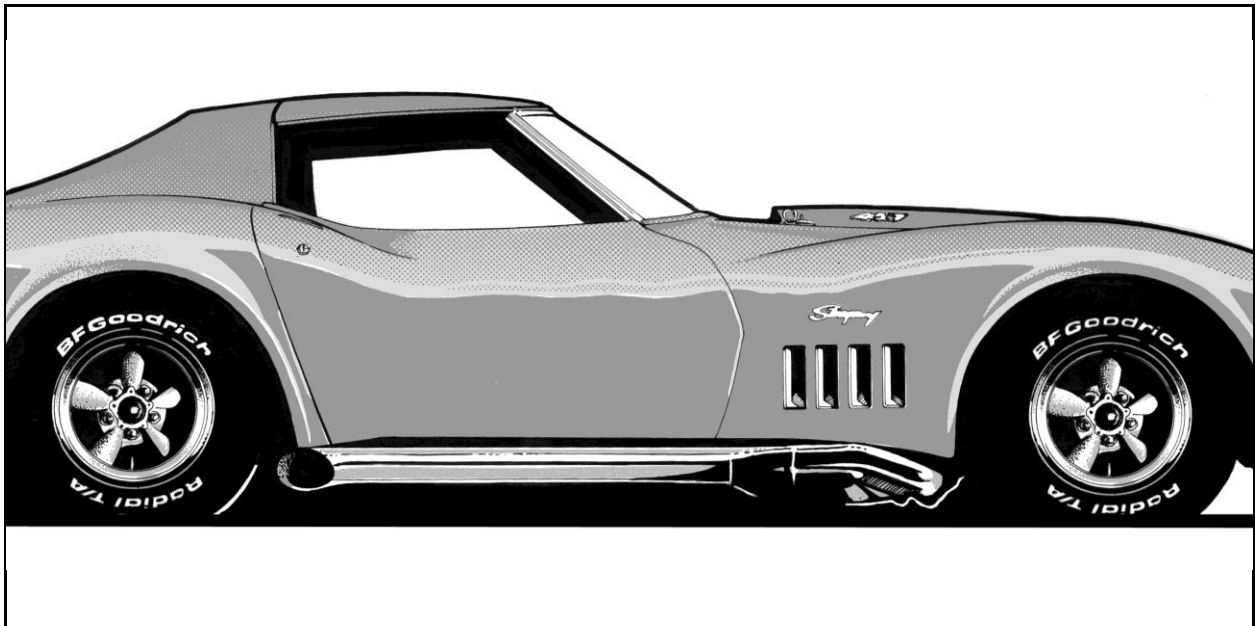
Low Volume Vehicle Technical Association Incorporated

Low Volume Vehicle Standard

90-20(05)

(Exhaust Noise Emissions)

This Low Volume Vehicle standard corresponds with Land Transport Rule: Vehicle Equipment Amendment 2011.



5th Amendment – effective from: 25 October 2016

Signed in accordance with clause 1.5 of the Low Volume Vehicle Code, on.....by on behalf of the New Zealand Transport Agency:by on behalf on the Low Volume Vehicle Technical Association (Inc):
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LVV Standard 90-20 Amendment Record:

No:	Detail of amendments:	Version:	Issue date:	Effect date:
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2	1 st Amendment	90-20(01)	1 February 2007	1 April 2007
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6	5 th Amendment	90-20(05)	25 October 2016	25 October 2016

Note that highlighted text shows amendments that have been made subsequent to the document’s previous issue, and a grey vertical stroke to the left of the text denotes information that is of a technical (rather than a formatting) nature.

Overview

Background

The Low Volume Vehicle Technical Association Incorporated (LVVTA) represents ten specialist automotive groups who are dedicated to ensuring that vehicles, when scratch-built or modified, meet the highest practicable safety standards. The information in these standards has stemmed from work undertaken by LVVTA founding member organisations that commenced prior to 1990 and has been progressively developed as an integral part of NZ Government safety rules and regulations by agreement and in consultation with the New Zealand Transport Agency. As a result, the considerable experience in applied safety engineering built up by LVVTA and the specialist automotive groups over the past twenty years can be of benefit to members of the NZ public who also wish to build or modify light motor vehicles.

Availability of low volume vehicle standards

Low volume vehicle standards are developed by the LVVTA, in consultation with the New Zealand Transport Agency, and are printed and distributed by the LVVTA. The standards are available to the public free of charge from the LVVTA website; www.lvvta.org.nz

Further information on the availability of the low volume vehicle standards may be obtained by contacting the LVVTA at info@lvvta.org.nz.

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Associated information

Other associated information relevant to the subject matter contained in this low volume vehicle standard, which in the interest of comprehensiveness, should be read in conjunction with this standard, includes:

Document	Page #/Section/Chapter
• LVV Information Sheet # 04-2011	2011 Exhaust Noise Information Update
• LVV Information Sheet # 07-2011	Objective Noise Test Information Package
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Note that all documents referred to in this table, with the exception of the NZ Car Construction Manual, can be accessed from www.lvvta.org.nz free of charge. For information on obtaining the NZ Car Construction Manual, contact info@lvvta.org.nz

Note also that paper copies of documents can become out of date and as such should not be relied upon, therefore LVVTA advises users of this standard to check to ensure that the Associated Information listed here is current, by going to www.lvvta.org.nz/standards.html

Contents

Purpose of this standard		Page 5
Section 1	Scope and application of this standard	5
1.1	Scope of this standard	5
1.2	Application of this standard	6
Section 2	Technical and procedural requirements of this standard	6
2.1	Exhaust system requirements	6
2.2	Test site requirements	8
2.3	Field calibrator requirements	8
2.4	Sound level meter requirements	9
2.5	Tachometer requirements	9
2.6	Engine speed selection requirements	10
2.7	Vehicle preparation requirements	12
2.8	Test procedure requirements	13
2.9	Decibel level requirements	18
2.10	Reporting requirements	20
Section 3	Exclusions to this standard	20
Section 4	Vehicles not required to be certified to this standard	20
4.1	Vehicles not covered by this standard	20
4.2	Vehicles that are not subject to objective noise testing	20
Section 5	Terms and definitions within this standard	21

Exhaust Noise Emissions

(90-20[05])

Purpose of this standard

The purpose of this low volume vehicle standard is to specify a set of technical requirements, together with an associated testing process, for measuring exhaust noise emissions from new scratch-built vehicles, and from modified and scratch-built light vehicles that have been referred by an authorised vehicle inspector – during either used entry or in-service compliance – or member of the NZ Police, for an objective exhaust noise emission test. The standard provides a test method and procedure that has been derived from international best practice, which is applied in controlled conditions, and which will result in an accurate, repeatable, and legally-defensible outcome.

Section 1 Scope and application of this standard

1.1 Scope of this standard

1.1(1) This low volume vehicle standard applies to all light vehicles other than those specified in 1.1(2), that are:

- (a) production vehicles which are required to undergo an objective exhaust noise emission test for the purpose of either:
 - (i) achieving entry compliance on or after 19 July 2006; or
 - (ii) maintaining in-service compliance on or after 1 June 2008;

or

- (b) scratch-built low volume vehicles that are first registered or re-registered in New Zealand on or after 1 December 2008.

1.1(2) This low volume vehicle standard does not apply to:

- (a) powered bicycles of Class AB; or
- (b) a vehicle that is not powered by an internal combustion engine; or
- (c) a production vehicle that retains the vehicle manufacturer's original equipment exhaust system in unmodified condition, provided that the vehicle has not been referred by the New Zealand Police and is 'green-stickered' or 'pink-stickered' for emitting excessive noise; or

- (d) a vehicle that has been referred for objective exhaust noise emission testing solely on the basis of exhaust leaks or an exhaust system that is in poor condition; or
 - (e) a Class MA or Class MC motor sport vehicle that complies with Motorsport New Zealand rules and regulations and is either:
 - (i) competing in an event that has been sanctioned by Motorsport New Zealand, or is being driven directly to or from competition in such an event; or
 - (ii) being used on a road for the purpose of inspection, certification, servicing or repair of the vehicle;
- or
- (f) those vehicles specified in *section 4*.

1.2 **Application of this standard**

- 1.2(1) A light vehicle that is required to undergo an objective exhaust noise emission test as in *1.1(1)*, must comply with all applicable technical and procedural requirements contained in *section 2* of this low volume vehicle standard.

NOTE: A vehicle specified in *1.2(1)* does not necessarily become a low volume vehicle, however in the interest of brevity, such a vehicle is referred to throughout this standard as a low volume vehicle.

Section 2 Technical and procedural requirements of this standard

2.1 **Exhaust system requirements**

Exhaust system design and condition

- 2.1(1) An exhaust system fitted to a low volume vehicle must be:
- (a) of a good design using materials suitable for the purpose; and
 - (b) in good condition and free of leaks; and
 - (c) securely attached to the vehicle, using a mounting system that enables all necessary engine movement without stressing the exhaust system.

- 2.1(2) The body of a low volume vehicle must, in the areas adjacent to the vehicle's exhaust system, be sufficiently sealed so as to prevent the entry of any exhaust gases into the passenger compartment.

Exhaust system interference

- 2.1(3) An exhaust system fitted to a low volume vehicle must be designed, constructed, and fitted in such a way that:
- (a) the exhaust system, or components within the exhaust system, cannot be removed, altered, or interfered with, without the use of hand tools; or
 - (b) the performance or operation of the exhaust system cannot be altered from inside the vehicle, or whilst the vehicle is in motion, in such a way that the decibel levels specified in 2.9 are exceeded, unless the vehicle is fitted with such a system as original equipment to the vehicle in question by a high volume vehicle manufacturer.

NOTE: The requirement specified in 2.1(3)(b) means that a multi-mode exhaust system cannot be designed into a scratch-built vehicle or retro-fitted into a modified production vehicle, unless the maximum permissible decibel levels in 2.9 are not exceeded in any available mode.

Exhaust system protection & external projections

- 2.1(4) Sections of an exhaust system which extend beyond the outer longitudinal extremity of the vehicle, or the outer sidewall of the tyres, must:
- (a) not present any sections of open exhaust tubing or sharp edges facing toward the front of the vehicle; or
 - (b) have any sections of exposed exhaust adjacent to points of occupant entry and exit adequately heat-shielded, to prevent burn injuries in the event of being contacted by occupants entering or exiting the vehicle.

Exhaust system positioning

- 2.1(5) An exhaust system fitted to a low volume vehicle must be positioned so that it:
- (a) is isolated from the passenger compartment; and
 - (b) terminates in a position where the outer end of the exhaust pipe is not directly underneath the passenger compartment.

2.2 Test site requirements

- 2.2(1) A test site used in the application of this standard must be an open outdoor site that:
- (a) is predominantly flat, particularly within the immediate test area; and
 - (b) incorporates within a radius of not less than 3 metres (10 feet) from the sound level meter microphone:
 - (i) a space free from large sound-reflecting surfaces including buildings, walls, billboards, vehicles, trees, or shrubs; and
 - (ii) a solid surface such as concrete or asphalt, free of any loose or sound-absorbing material.
- 2.2(2) Exhaust noise emission testing on a low volume vehicle may be carried out under a canopy, provided that no part of the canopy, including its supports, are within 3 metres (10 feet) of the sound level meter microphone.

NOTE: Accurate and repeatable exhaust noise emission test results can only be obtained by using a location with a solid ground surface and no major sound reflecting surfaces, such as a large car park.

2.3 Field calibrator requirements

- 2.3(1) A field calibrator used in the application of this standard must be:
- (a) specifically approved and issued for that purpose by the Low Volume Vehicle Technical Association (Inc); and
 - (b) in good operating condition; and
 - (c) re-calibrated by an approved calibration laboratory at intervals specified by the Low Volume Vehicle Technical Association (Inc).

NOTE 1: As a general rule, calibration intervals for field calibrators will be as specified by the equipment manufacturer, in accordance with ISO Standard 5130:2007.

NOTE 2: Field calibrators referred to in 2.3(1), whilst issued by LVVTA, are purchased and supplied for the purpose of objective exhaust noise testing by the New Zealand Transport Agency.

NOTE 3: The process of collection, re-calibration, and re-issue of the field calibrators, as required by 2.3(1)©, will be arranged by LVVTA and the New Zealand Transport Agency.

2.4 Sound level meter requirements

- 2.4(1) A sound level meter used in the application of this standard must be:
- (a) a Class-1, Type-0 or Type-1 meter, specifically approved and issued for that purpose by the Low Volume Vehicle Technical Association (Inc); and
 - (b) in good operating condition; and
 - (c) re-calibrated by an approved calibration laboratory at intervals specified by the Low Volume Vehicle Technical Association (Inc).

NOTE 1: As a general rule, calibration intervals for sound level meters will be as specified by the equipment manufacturer, in accordance with ISO Standard 5130: 2007.

NOTE 2: Sound level meters referred to in 2.4(1), whilst issued by LVVTA, are purchased and supplied for the purpose of objective exhaust noise testing by the New Zealand Transport Agency.

NOTE 3: The process of collection, re-calibration, and re-issue of the sound level meters, as required by 2.4(1)(c), will be arranged by LVVTA and the New Zealand Transport Agency.

- 2.4(2) A Low Volume Vehicle Certifier may use a Type-2 sound level meter in conjunction with the test process prescribed by this low volume vehicle standard, provided that the Type-2 sound level meter is:
- (a) used only for the purpose of establishing a vehicle's approximate exhaust noise level prior to a full test conducted in accordance with this low volume vehicle standard being carried out; and
 - (b) specifically approved and issued for that purpose by the Low Volume Vehicle Technical Association (Inc); and
 - (c) in good operating condition.

NOTE: The use of a Type-2 sound level meter is strictly limited to preliminary 'quick-check' work. The aim of allowing this is to reduce costs and inconvenience to the vehicle owner leading up to the full test, so that the likelihood of a 'pass' when applying the full test in accordance with this low volume vehicle standard is maximised. No written approval may be provided by a Low Volume Vehicle Certifier through the use of a Type-2 meter, or a 'quick check' process, unless it is for the purpose of informing an inspector that a vehicle which has failed a Warrant of Fitness for exhaust noise clearly passes.

2.5 Tachometer requirements

- 2.5(1) A tachometer used in the application of this standard must where practical, be proven by calibration to be within +/- 2% accuracy, and be:

- (a) specifically approved and issued for that purpose by the Low Volume Vehicle Technical Association (Inc); and
- (b) in good operating condition; and
- (c) re-calibrated by an LVVTA-approved instrument calibration laboratory at intervals specified by the Low Volume Vehicle Technical Association (Inc).

NOTE 1: A tachometer referred to in 2.5(1)(a), whilst issued by LVVTA, is purchased and supplied for the purpose of objective exhaust noise testing by the New Zealand Transport Agency.

NOTE 2: The process of collection, re-calibration, and re-issue of the tachometers, as required by 2.5(1)(c), will be arranged by LVVTA and the New Zealand Transport Agency.

2.5(2) A tachometer used in the application of this standard may be either:

- (a) a calibrated remote inductive pick-up tachometer issued by the Low Volume Vehicle Technical Association (Inc); or
- (b) where a tachometer specified in 2.5(2)(a) will not enable a reliable engine speed reading to be received due to the type of ignition system used within the vehicle, a calibrated infra-red tachometer issued by the Low Volume Vehicle Technical Association (Inc); or
- (c) where neither tachometer specified in 2.5(2)(a) nor 2.5(2)(b) will enable a reliable reading to be received, the vehicle's original equipment tachometer or other trusted engine speed measurement device.

NOTE 1: An approved tachometer may be used either as the means by which to measure engine speed during the exhaust noise emission test, or as a means by which to verify the vehicle's original equipment tachometer.

NOTE 2: An infra-red meter will almost always read the engine speed from a bold white marking or piece of reflective tape placed on the engine's crankshaft pulley. This option however, may necessitate an assistant to help the LVV certifier.

NOTE 3: In cases where the supplied tachometers are not suitable and the vehicle is not equipped with a tachometer, as referred to in 2.5(2)(c), in the interests of completing the test, the certifier may elect to use an alternative engine speed measurement device that is known to have good accuracy, such as a suitably equipped professional timing light or automotive multi-meter with inductive input.

2.6 Engine speed selection requirements

Engines other than a motorcycle engine

2.6(1) The engine speed for the exhaust noise emission test of an engine other than a motorcycle engine, must, for the duration of each test, be within a tolerance of +/- 5% of either:

- (a) in the case of an engine that has a manufacturer's engine speed maximum power (ESMP) that is known to the LVV certifier, 75% of that figure; or
- (b) in the case of an engine that does not have a manufacturer's ESMP that is known to the LVV certifier, or the manufacturer's ESMP has become irrelevant because the engine is now outside of its original specification:
 - (i) 4500 RPM if the engine is a rotary engine; or
 - (ii) 4000 RPM if the engine has five or less cylinders; or
 - (iii) 4800 RPM if the engine has five or less cylinders and is of a double over-head camshaft and variable valve timing engine design; or
 - (iv) 3200 RPM if the engine has six cylinders; or
 - (v) 3000 RPM if the engine has eight cylinders; or
 - (vi) 4000 RPM if the engine has more than eight cylinders; or
 - (vii) 2500 RPM if the engine is a diesel engine;

or

- (c) in the case where a low volume vehicle certifier believes the engine speeds specified in 2.6(1)(b) are unreasonably high, taking into account the type and age of the engine, he may apply an engine speed for the purpose of the sound level test at which he believes is appropriate for the engine, and at which the engine may be safely operated.

Motorcycle engines

2.6(2)

The engine speed for the exhaust noise emission test of a motorcycle engine, must, for the duration of each test, be within a tolerance of +/- 5% of either:

- (a) in the case of an engine that has a manufacturer's engine speed maximum power (ESMP) that is known to the LVV certifier, 50% of that figure; or
- (b) in the case of an engine that does not have a manufacturer's ESMP that is known to the LVV certifier, or the manufacturer's ESMP has become irrelevant because the engine is now outside of its original specification:
 - (i) 6000 RPM if the engine is a 2-stroke single-cylinder engine; or

- (ii) 5000 RPM if the engine is a 2-stroke multi-cylinder engine; or
- (iii) 3000 RPM if the engine is a 4-stroke single-cylinder engine; or
- (iv) 2500 RPM if the engine is a 4-stroke twin-cylinder engine with 2 valves per cylinder; or
- (v) 4000 RPM if the engine is a 4-stroke twin-cylinder engine with 3 or more valves per cylinder; or
- (vi) 4500 RPM if the engine is a 4-stroke engine that has three or more cylinders;

or

- (c) in the case where a low volume vehicle certifier believes the engine speeds specified in 2.6(2)(b) are unreasonably high, taking into account the type and age of the engine, he may apply an engine speed for the purpose of the sound level test at which he believes is appropriate for the engine, and at which the engine may be safely operated.

2.7 Vehicle preparation requirements

2.7(1) The engine in a low volume vehicle which undergoes an exhaust noise emission test, must, prior to the commencement of the test, be brought up to normal operating temperature.

2.7(2) A low volume vehicle which undergoes an exhaust noise emission test must be positioned centrally within a test site that meets the requirements specified in 2.2, and must:

- (a) be stationary; and
- (b) have the parking brake applied; and
- (c) have the gear selector positioned either:
 - (i) in the case of a manual transmission-equipped vehicle, in neutral; or
 - (ii) in the case of an automatic transmission-equipped vehicle, in park;

and

- (d) in the case of a two-wheeled vehicle that does not have a neutral gear position, have the driving wheel off the ground; and
- (e) have the air conditioning system, if fitted, turned off; and
- (f) have the engine hood, if fitted, closed.

NOTE: A vehicle specified in 2.7(2)(d) will have to be safely and securely supported during the testing process.

2.7(3) In a case where it is believed that one or more noises emitted by the vehicle, other than exhaust outlet noise, is adversely influencing the total noise recorded, the exhaust outlet noise may be isolated from the other noise sources by using shielding around the vehicle, providing that the shielding material:

- (a) is not within 50 mm of the exhaust outlet; and
- (b) does not obstruct the clear path between exhaust outlet and microphone position.

NOTE: Suitable shielding may include acoustic partitions, layers of fibre 'batts' insulation, or sand bags. Care must be taken to avoid the risk of combustion of shielding material.

2.8 Test procedure requirements

Background noise testing

2.8(1) The combination of wind or other background noise present at an exhaust noise emission test, if any, must:

- (a) be at least 10 dBA below the sound level of the vehicle being tested; and
- (b) be measured both prior to, and after the completion of, the exhaust noise emission test process.

NOTE: Wind can cause high readings to be displayed on a sound level meter, and consistent vehicle noise measurements cannot be made when wind is affecting the readings. By meeting the requirements specified in 2.8(1), any additional noise caused by wind and any other sources producing background noise will not adversely affect the exhaust noise emission testing outcome.

Field calibration checking

2.8(2) A sound level meter used in the application of this standard must, before and after each exhaust noise emission test:

- (a) undergo a field calibration check against a field calibrator issued by the Low Volume Vehicle Technical Association (Inc); and

- (b) record a difference between the two checks of not more than 0.5 dBA.

NOTE 1: If more than 0.5 dBA difference is recorded between the two calibration checks specified in 2.8(2), the test must be disregarded and carried out again.

NOTE 2: A field calibrator referred to in 2.8(2) is part of the sound level meter equipment, and whilst issued by LVVTA, is purchased and supplied for the purpose of objective exhaust noise testing by the New Zealand Transport Agency.

Microphone set-up and positioning

2.8(3) The sound level meter microphone, when testing a low volume vehicle for exhaust noise emissions, in all cases, including those specified in 2.8(4) to 2.8(8), must:

- (a) be protected by a foam wind-shield at all times during the noise emission test set-up and testing process; and
- (b) be positioned at: (see diagrams 2.1 and 2.2)
- (i) a distance from the exhaust outlet of 500 mm (+/- 10 mm), except where the vehicle meets the criteria specified in 2.8(7); and
 - (ii) an angle of 45 degrees (+/- 5 degrees) to the direction of gas flow, always using the position furthest from the vehicle's longitudinal centreline; and
 - (iii) the same height as the exhaust outlet, however not closer to the ground than 200 mm.

NOTE: Where a vehicle's exhaust outlet is closer to the ground than 200 mm, the microphone must be positioned no lower than 200 mm from the ground. This is in order to avoid 'sound bounce' affecting the test results.

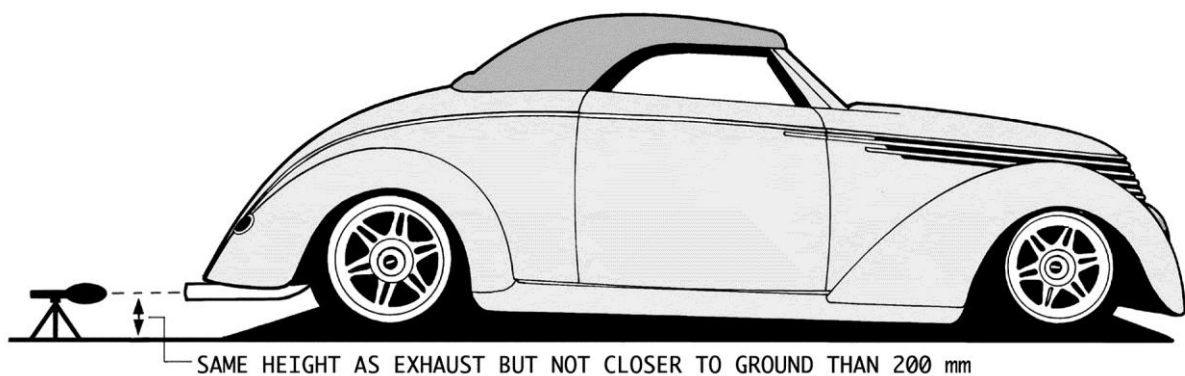


Diagram 2.1 Microphone positioning for single exhaust outlet (side view)

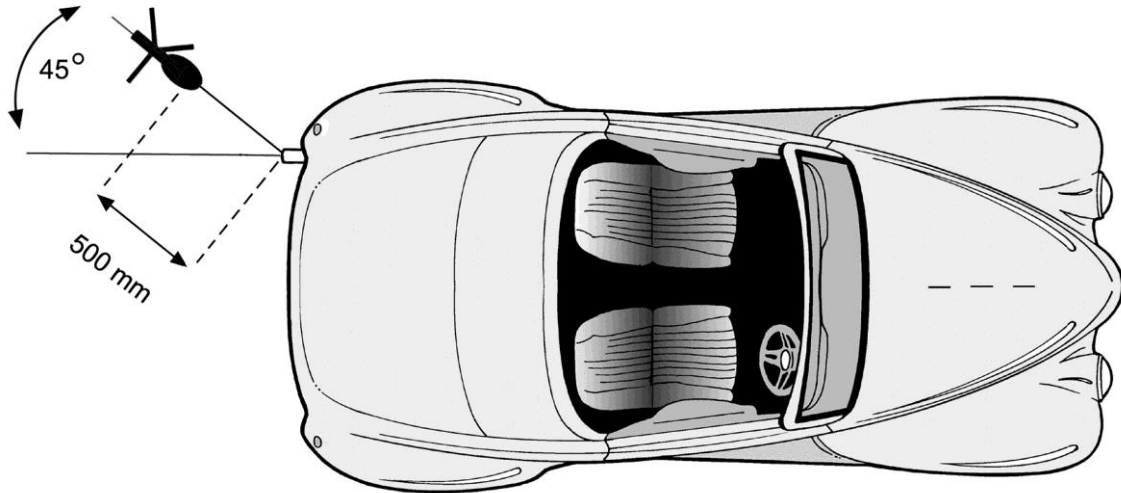


Diagram 2.2 Microphone positioning for single exhaust outlet (plan view)

Microphone positioning with two exhaust outlets

- 2.8(4) In the case of a low volume vehicle with two exhaust outlets, and the two outlets are less than 300 mm apart, the outlets must be treated as one and measured together, with the sound level meter microphone positioned at the exhaust outlet that is furthest from the vehicle’s longitudinal centreline.

- 2.8(5) In the case of a low volume vehicle with two exhaust outlets, and the two outlets are more than 300 mm apart (see diagram 2.3), the outlets must be treated as two separate outlets and measured individually, with the figure from the loudest outlet taken as the result.

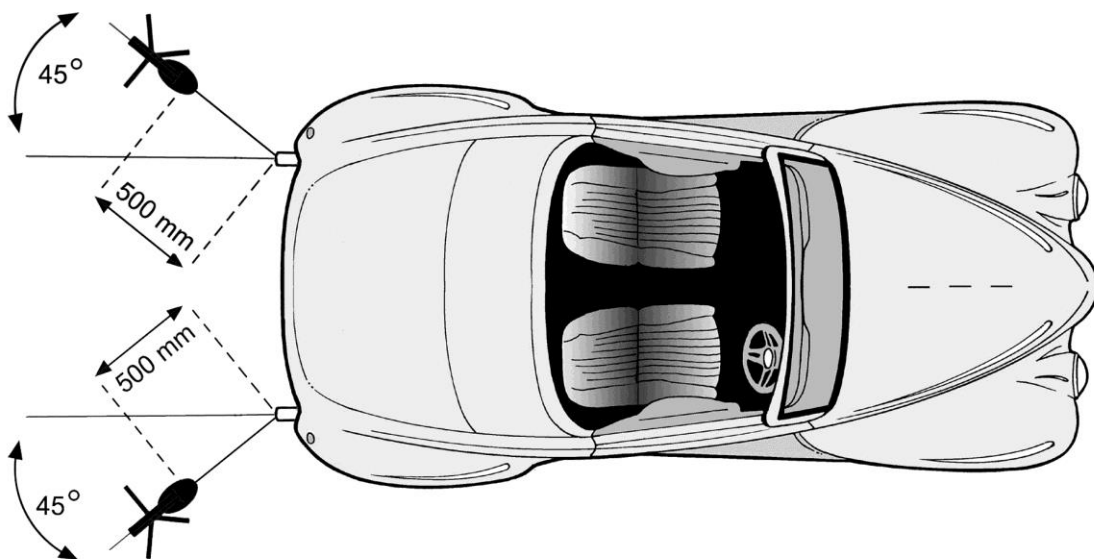


Diagram 2.3 Microphone positioning for twin exhaust outlets

Microphone positioning with other unusual exhaust outlets

- 2.8(6) In the case of a low volume vehicle that has an exhaust outlet located at an angle to the vehicle's longitudinal centreline, the sound level meter microphone must be positioned at the point which is furthest from the engine. (see diagram 2.4)

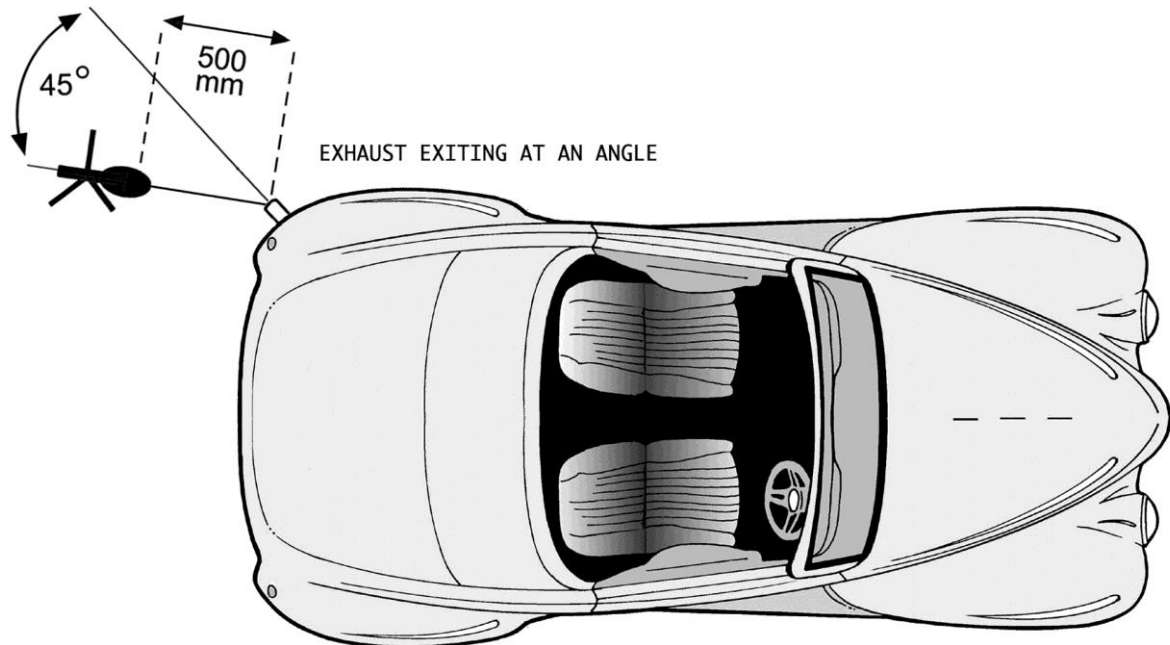


Diagram 2.4 Microphone positioning for angled exhaust outlets

- 2.8(7) In the case of a low volume vehicle that has an exhaust outlet that terminates under the vehicle body, the sound level meter microphone must be positioned as closely as practical to the outlet, however the sound level meter microphone must not: (see diagram 2.5)

- (a) be positioned any closer to the vehicle body than 200 mm; and
- (b) have any part of the vehicle obstructing a clear path between it and the exhaust outlet, and may, in order to achieve a clear path, be positioned at less than 45 degrees to the direction of gas flow, provided that the sound level meter microphone is no closer to the exhaust outlet than 500 mm.

NOTE 1: The microphone must never be positioned closer to the vehicle body than 200 mm. This is in order to avoid 'sound bounce' affecting the test results.

NOTE 2: For other exhaust outlet positions not described within this low volume vehicle standard, such as a vertical stack, an LVV certifier should seek advice from a Technical Team member at the LVVTA office.

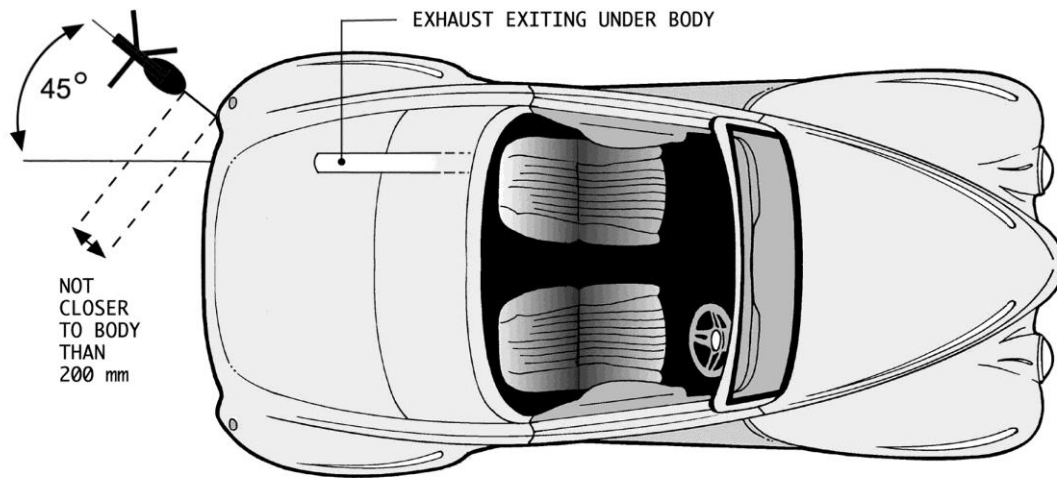


Diagram 2.5 Microphone positioning for exhaust outlets that terminate under vehicle body

Testing multi-mode exhaust systems

- 2.8(8) In the case of a low volume vehicle that is fitted with a multi-mode exhaust system and a manual exhaust control, the exhaust noise emission test must be carried out with the mode switch in all positions, with the highest sound level recorded taken as the test figure.

Sound level meter setting

- 2.8(9) When testing a low volume vehicle for exhaust noise emissions:
- (a) the sound level meter microphone must be self-supported; and
 - (b) the sound level meter must be set at:
 - (i) 'curve-A' or 'A-weighted' sound pressure level; and
 - (ii) 'fast response', or 'time weighting F'.

Sound level meter activation and recording

- 2.8(10) During exhaust noise emission testing on a low volume vehicle, no person may be present within a radius of 3 metres (10 feet) of the vehicle undergoing sound level testing, other than:
- (a) the low volume vehicle certifier; and
 - (b) if required, one additional person appointed by the low volume vehicle certifier to assist with the exhaust noise emission test.

- 2.8(11) During exhaust noise emission testing of a low volume vehicle, the sound level meter must record the exhaust noise level held constantly for a period of not less than one second at the selected engine speed specified in 2.6(1), and throughout the deceleration period back to idle.

NOTE: The standardised test process for sound level meter activation and recording must incorporate the following steps:

- adjust the throttle to bring the engine speed up to the selected level;
- begin recording noise output;
- hold the engine speed for several seconds;
- release the throttle and allow the engine speed to fall naturally back to idle;
- once at idle, stop recording noise output.

Interpretation of sound level test results

- 2.8(12) The figure recorded for each exhaust noise emission test of a low volume vehicle must be to one decimal point.
- 2.8(13) The result of an exhaust noise emission test of a low volume vehicle must be calculated from the average of three separate and consecutive measurements, each of which must be within 2 dBA of each other.
- 2.8(14) The final decibel figure established for a low volume vehicle after an exhaust noise emission test, and application of any applicable factoring specified in 2.9, must be rounded to the nearest whole dBA value.
- 2.8(15) An unusual or unrelated noise spike or peak that occurs when carrying out an exhaust noise emission sound level test on a low volume vehicle must not be taken into account as part of the test results, in which case the test must be repeated until a satisfactory result is achieved.

NOTE: A noise spike or peak referred to in 2.8(15) does not include an exhaust over-run 'boom', but rather is intended to apply to unusual or intermittent one-off sounds unrelated to the exhaust noise from the surrounding environment, such as a loud bang, aircraft flying past, or a barking dog.

Rattling noises such as those made at certain engine speeds by number plates or non-exhaust heat-shields during the test can also cause an unwanted spike or peak.

2.9 Decibel level requirements

Decibel limits

- 2.9(1) The maximum permissible decibel level emitted by a low volume vehicle tested in accordance with this standard, must not, except for in the case of where factoring must be applied for one or more of the situations specified in 2.9(2) to 2.9(4), exceed:

- (a) in the case of a moped (LA or LB-Class), 91 dBA; or
- (b) in the case of a motorcycle with an engine capacity of 125 cc or less (LC, LD or LE-Class), 96 dBA; or
- (c) in the case of a motorcycle with an engine capacity of more than 125 cc (LC, LD or LE-Class), 100 dBA; or
- (d) in the case of an MA, MB, MC, MD1, MD2, or NA-class vehicle that was manufactured before 1 January 1985, 95 dBA; or
- (e) in the case of an MA, MB, MC, MD1, MD2, or NA-class vehicle that was manufactured on or after 1 January 1985:
 - (i) if first registered in New Zealand before 1 June 2008, 95 dBA; or
 - (ii) if first registered in New Zealand on or after 1 June 2008, 90 dBA.

NOTE 1: The decibel figures specified in 2.9(1) are the figures set by the Government, as specified in *Land Transport Rule: Vehicle Equipment Amendment 2011*, and may change from time to time as Government policy dictates. Such changes will be reflected in an amendment to this low volume vehicle standard.

NOTE 2: 'dB' refers to 'decibels', and the 'A' denotes 'A-weighted decibels', which is an adjustment process that takes into account the varying sensitivity of the human ear, to different decibel levels at different frequencies. Low frequency sounds are quieter to the human ear. The 'A' weighting curve primarily takes into account the 500-10,000 Hz frequency range.

Decibel factoring for specific situations

2.9(2) A factor of 4 dBA may be subtracted from the average decibel level recorded in 2.8(13), in order to compensate for the increased background noise caused by the close proximity of the engine to the exhaust outlet, in the case of a low volume vehicle, other than a motor-cycle, that has either:

- (a) the engine positioned to the rear of the driver; or
- (b) the exhaust outlet positioned within 1.5 metres (5 feet) of the engine.

2.9(3) A factor of 2 dBA may be subtracted from the average decibel level recorded in 2.8(13), in the case of a low volume vehicle, other than a motor-cycle or one that has the factor specified in 2.9(2) already applied, that incorporates a particular type of engine, or engine equipment or components, that emits an unusually high level of mechanical sound, if the low volume vehicle certifier believes that the exhaust noise emission figure may be influenced by that engine type, equipment, or components.

- 2.9(4) A factor of 5 dBA may be subtracted from the average decibel level recorded in 2.8(13), in the case of a scratch-built low volume vehicle of scratch-built sub-category 'Historic Replica', or scratch-built sub-category 'Reproduction', first registered in New Zealand on or after 1 June 2008, that is a replication or reproduction of a vehicle manufactured before 1 January 1985.

NOTE 1: An engine type referred to in 2.9(3) is typically a diesel engine or an air-cooled engine, and the components or equipment referred to in 2.9(3) may include cooling fans, mechanical belt-driven superchargers, gear-driven camshafts and balance shafts, belt-driven primary drives, and dry clutches. In order for such components to have an influence on the exhaust noise emission testing, it will generally either have no effective shielding surrounding it, or be positioned within two metres (six feet) of the sound level meter microphone.

NOTE 2: In a case where shielding around the vehicle is used as described in 2.7(3), the decibel factoring noted in 2.9(2) and 2.9(3) cannot be applied.

2.10 Reporting requirements

- 2.10(1) The documented reporting of an exhaust noise emission test on a low volume vehicle must incorporate:
- (a) the make, model, year, colour, and VIN of the vehicle to which the exhaust noise emission test has been applied; and
 - (b) the location of the test site; and
 - (c) the make, model, and serial number of the sound level meter used; and
 - (d) the background noise level measured before and after the tests; and
 - (e) the selected engine operating speed used for the test; and
 - (f) the applicable decibel limit from 2.9(1) that applies to the vehicle for the test; and
 - (g) a clear indication of whether the subject vehicle has passed or failed the test; and
 - (h) reference to this low volume vehicle standard; and
 - (i) a detailed description of the subject vehicle's exhaust system, which records the length, diameter, type, and material of the various components used within the system, and the basic shape, configuration, and positioning of the system; and
 - (j) a schematic illustration of the subject vehicle's exhaust system; and

- (k) at least one clear photograph of the subject vehicle's exhaust system.

Section 3 Exclusions to this standard

No exclusions are applicable to this low volume vehicle standard.

Section 4 Vehicles not required to be certified to this standard

4.1 Vehicles not covered by this standard

4.1(1) A light vehicle is not required to be certified to this low volume vehicle standard, if the vehicle is modified for the purposes of law enforcement or the provision of emergency services.

4.1(2) A light vehicle is not required to be certified to this low volume vehicle standard, if the vehicle is identified as having been modified by a second-stage vehicle manufacturer, and complies with an approved overseas standard that is listed in Annex 6 of the *Low Volume Vehicle Code*.

4.2 Vehicles that are not subject to objective noise testing

4.2(1) A vehicle is not required to be certified to this standard, if the vehicle is not:

- (a) a production vehicle which is required to undergo an objective exhaust noise emission test for the purpose of either:
- (i) achieving entry compliance on or after 19 July 2006; or
 - (ii) maintaining in-service compliance on or after 1 June 2008;

or

- (b) a scratch-built low volume vehicle that is first registered or re-registered in New Zealand on or after 1 December 2008; or
- (c) a MA-class or MC-Class motor sport vehicle that complies with Motorsport New Zealand rules and regulations and is:
- (i) competing in an event that has been sanctioned by Motorsport New Zealand, or is being driven directly to or from competition in such an event; or

- (ii) being used on a road for the purpose of inspection, certification, servicing or repair of the vehicle.

Section 5 Terms and definitions within this standard

A-weighted decibels	is an adjustment to measured or calculated sound pressure levels that accounts for the varying sensitivity of human hearing to sound at different frequencies.
Class	in relation to a sound level meter, describes its accuracy as defined by the relevant international standards. Type 1 is more accurate than Type 2. The ANSI S1.4 and older IEC 60651 standards refer to the level of accuracy as 'Type', whereas the new standard IEC 61672 refers to the level of accuracy as 'Class'.
dB	is an abbreviation for a 'decibel', which is a logarithmic measurement unit that describes a sound's relative loudness, though it can also be used to describe the relative difference between two power levels. A decibel is one tenth of a Bel. In sound, decibels generally measure a scale from 0 (the threshold of hearing) to 120-140 dB (the threshold of pain). A 10dB difference is required to double the subjective volume. Generally, if the distance from the noise source is doubled, the noise level will be 6dB lower. A 2-3dB difference over a broad frequency range is noticeable to most people.
dB(A)	means A-weighted decibels.
Engine speed at maximum power	means the rotational engine speed at which the engine develops its maximum amount of power.
ESMP	is an abbreviation for 'engine speed at maximum power'.
Hz	means Hertz, or cycles per second.
Motor-cycle	means a vehicle of Table-A class LA, LB, LC, LD, and LE.
Muffler	means a device for reducing the noise of the exhaust gases before they are released into the air through the tailpipe.
RPM	is an abbreviation for 'revolutions per minute', which means the number of times an engine's reciprocating assembly turns in one minute.
Scratch-built Historic Replica low volume vehicle	means a replica of a vehicle which was, or could have been, manufactured before 1960, that uses components, systems, materials, and engineering processes throughout its construction that are appropriate to the period in which the vehicle is styled, and either:

- (a) is an accurate historical representation of a vehicle built from a particular period of motoring history; or
- (b) is not readily distinguishable from an original example of the specific make and model of production vehicle being replicated.

**Scratch-built
Reproduction
low volume
vehicle**

means a vehicle which is clearly recognisable as a reproduction of a specific make and model of production motor vehicle, and maintains an actual or approximate silhouette of the vehicle being reproduced, and uses an amalgamation of period and modern components, systems, materials, and engineering processes throughout its construction.

Tachometer

means an instrument by which the rotational speed of an engine is measured.

Type

in relation to a sound level meter, see the definition for 'Class'.

NOTE: The terms and definitions found in section 5 are limited to those terms and definitions that are unique to this low volume vehicle standard, and are not necessarily contained within the terms and definitions section of the *Low Volume Vehicle Code*.