



Simplified Emissions Test Procedure

Portable Emissions Measurement Systems

February 2019

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1 Introduction

When carrying out modifications to a heavy vehicle engine, the National Heavy Vehicle Regulator (NHVR) requires the modifier to demonstrate that the vehicle continues to comply with the emission requirements applied to the vehicle under the Australian Design Rules (ADRs).

For modifications that are:

- **within manufacturers specifications** – this can be demonstrated through reference to evidence of compliance produced by the manufacturer
- **outside the manufacturers specifications** – [Vehicle Standards Bulletin 6 \(VSB6\): National Code of Practice—Heavy Vehicle Modifications](#) requires that ADR specified emissions testing is conducted to demonstrate ongoing compliance.

For vehicles manufactured to comply with ADR 70/00 *Exhaust Emission Control for Diesel Engined Vehicles* and [80/03 Emission Control for Heavy Vehicles](#) (or earlier versions), ADR emissions testing is an expensive laboratory test that is prohibitive when only conducted for a single vehicle, or very small volumes of vehicles, as the engine must be removed from the vehicle to undertake the test.

While there is established simplified emission testing methods such as DT80 for early vehicles, these are not able to be used on later model vehicles. To provide a means of testing ADR 80/03 and earlier vehicles, the NHVR has developed an alternate emissions testing procedure that allows the use of portable emissions measurements systems (PEMS).

2 Application

2.1 Authority

This procedure is the *Simplified Emissions Test Procedure—Portable Emissions Measurement Systems* referenced in Section A – Engines of VSB6. This procedure forms part of VSB6.

VSB6 is a recognised modification standard under the [NHVR's Code of Practice for the Approval of Heavy Vehicle Modifications](#), which is prescribed by section 12 of the *Heavy Vehicle (Vehicle Standards) National Regulation*.

This procedure commences on 1 February 2019.

2.2 Definitions

Unless otherwise stated in *Appendix – Dictionary*, the terms used in this procedure have the same meaning as those defined in the Heavy Vehicle National Law (HVNL) or VSB6.

2.3 Applicability

This procedure must only be used to verify the emissions performance of a vehicle that:

- is being modified under Section A – Engines of VSB6; and
- was manufactured to comply with either ADR 70/.. *Exhaust Emission Control for Diesel Engined Vehicles* or *80/03 Emission Control for Heavy Vehicles* (or earlier versions or ADR 80).

Note: ADR70/.. or ADR80/03 (or earlier) components certified for a particular vehicle engine variant may be used for other variants of that engine, provided the engine family and parent engine criteria of the applicable Standard are met.

3 Test facilities and equipment

3.1 Test facilities

All tests specified in this procedure must be conducted by a facility that is either:

- registered with the National Association of Testing Authorities as an accredited facility for emissions testing
- registered with the Department of Infrastructure, Regional Development and Cities under the Road Vehicle Certification Scheme for vehicle emissions testing
- accredited to *ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories*
- approved by the NHVR as they, in the NHVR's opinion, are qualified to carry out the testing.

3.2 Testing equipment

The following requirements will be addressed when testing:

- All equipment used for testing will meet and be calibrated in accordance with *UNECE Regulation No.49 Revision 6*.
- Calibration records for each component will be maintained for a period of five years.

4 Vehicle selection

4.1 Vehicle selection

Vehicles selected for testing must meet the following requirements:

- The vehicle is in a roadworthy condition and serviced in accordance with the manufacturer's instructions.
- All OEM emission equipment is fitted, operational and in good working order.
- The vehicle, based on its vehicle category, is within the mileage and age limits specified under ADR 80/03 (or earlier) for durability of emission control systems.

4.2 Modification not covered by VSB6

Vehicles modified in a manner not provided for by VSB6 require approval by the NHVR.

A request to approve a modification not covered by VSB6 can be made by completing and submitting a [NHVR Vehicle Standards Modification Application](#)¹. It is also important to understand that vehicles modified to operate on an alternate fuel or powertrain system must meet any additional requirements set out by governing authorities (i.e. gas authorities).

5 Testing procedure

Other than where specified in 5.3 Variations, the emissions tests must be conducted in accordance with the test procedure outlined in *Annex 8 of UNECE Regulation No. 49 Revision 6*.

5.1 Requirements prior to testing

Prior to conducting each test sequence, ensure the following-

- engine and emissions systems are in an operational condition
- where an on-board diagnostic (OBD) system exists:
 - no check engine or emissions system codes present
 - the OBD system check is carried out prior to and after each emissions test sequence.

Note: If during, or immediately after the test, a check engine code is set, the test is deemed invalid and the vehicle must be repaired or the alternative fuel system technology rectified prior to retesting.

¹ <https://www.nhvr.gov.au/safety-accreditation-compliance/vehicle-standards-and-modifications/heavy-vehicle-modifications>

5.2 Test route

When developing the test route for testing, the following must be followed:

- apart from variations permitted in 5.3 Variations, the requirements specified in *Annex 8 of UNECE Regulation No. 49 Revision 6*.
- a report detailing the test route (including any variations as permitted in 5.3 Variations) must be produced to ensure consistency of testing and record keeping purposes.

Note: The planned test route is to remain unchanged between baseline tests and the modified vehicle tests. However, minor variations of the test route for unplanned changed traffic and road conditions (such as diversions) are acceptable providing the entire test remains within limits. Such minor variations should be noted in the report.

5.3 Variations

The following are acceptable minor variations from the approved test procedure outlined in *UNECE Regulation No. 49 Revision 6*:

- When developing the vehicle's test route in accordance with the *UNECE*, variation to vehicle speed and proportion of the test operated in each condition (urban, rural and motorway) can be varied to reflect Australian conditions and better represent actual vehicle operating conditions. Any variations from the *UNECE* requirements must be justified in test route report.
- Fuel flow meters complying with the *US EPA CFR 1065* may be used in lieu of an exhaust flow meter when testing to *UNECE* regulation.
- Where particulate matter (PM) measurements are made, they may be either:
 - constant dilution sampling; or
 - proportional sampling of the exhaust gas.
- The concentration gas used to establish the analyser calibration curves must be higher than any values recorded for the test.

5.4 Acceptable test methods

A summary of acceptable test methods for heavy-duty vehicles or engines is outlined in the table below.

	System configuration	Mono fuel positive ignition engines	Dual fuel compression ignition and bi-fuel positive ignition engines
PEMS test as per UNECE Regulation 49 Revision 6	Allowable	Yes	Yes
	Emissions limit	ADR 80/03 and earlier: below a conformity factor of 1.5 times the applicable gaseous emissions standard	ADR 80/03 and earlier: below a conformity factor of 1.5 times the applicable gaseous emissions standard and/or for NO _x up to baseline emissions x 1.1.
	Emissions Limit Variation (non-Natural Gas engines)	NMHC and CH ₄ can be measured separately with a total limit of 1.65 g/kWh and a maximum CH ₄ limit of 1.10g/kWh.	NMHC and CH ₄ can be measured separately with a total limit of 1.65 g/kWh and a maximum CH ₄ limit of 1.10g/kWh.
	Number of vehicles	1 representative	1 representative

5.5 Testing method

5.5.1 Mono fuel positive ignition engines

Test procedure for mono fuel positive ignition engines:

Step	Action
1.	Convert the vehicle to operate on the new fuel and/or technology.
2.	Test the vehicle under the appropriate PEMS test specified for that mass and vehicle type.
3.	Record the relevant standard that the engine tested was homologated under

Note: It is recommended that the converted vehicle be run in for a minimum of 6,500km prior to retesting.

Acceptable emissions limits

Acceptable emissions limits for mono fuel positive ignition engines are detailed in the relevant standard. For the purpose of this procedure, these values may be adjusted as detailed below.

For ADR 80/03 and earlier	Ensure emissions in Step 2 are below the emissions limits of the relevant standard (or acceptable variation) with a conformity factor of 1.5 (gaseous emissions) applied.
For ADR 80/03 and earlier non-natural gas vehicles	NMHC and CH ₄ can be measured separately with a total limit of 1.65g/kWh and a maximum CH ₄ limit of 1.10g/kWh.

5.5.2 Dual fuel compression ignition and bi-fuel positive ignition engines

Test procedure for dual fuel compression ignition and bi-fuel positive ignition engines:

Step	Action
1.	Test the vehicle on the original fuel under the appropriate PEMS test specified for that mass and vehicle type. <ul style="list-style-type: none"> Ensure the emissions applicable to the relevant standard of the engine under test are recorded. These are the baseline emissions.
2.	Convert the vehicle to operate on the new fuel and/or technology.
3.	Retest with new fuel and/or technology in accordance with Step 1.
4.	If the vehicle is capable of functioning solely on its original fuel type following conversion, retest its original fuel type in accordance with Step 1.

Note: It is recommended that the converted vehicle be run in for a minimum of 6,500km prior to retesting.

Acceptable emissions limits

Acceptable emissions limits for dual fuel compression ignition and bi fuel positive ignition engines are detailed in the relevant standard. For the purpose of this procedure, these values may be adjusted as detailed below.

For ADR 80/03 and earlier	<ul style="list-style-type: none"> Ensure emissions in Step 3 and 4 are below the emissions limits of the relevant standard (or acceptable variation) with a conformity factor of 1.5 (gaseous emissions) applied. NO_x values measured in Steps 3 and 4 may be up to 1.1 times the baseline recorded NO_x emissions.
For ADR 80/03 and earlier non-natural gas vehicles	<ul style="list-style-type: none"> NMHC and CH₄ can be measured separately with a total limit of 1.65 g/kWh and a maximum CH₄ limit of 1.10g/kWh.

Appendix – Dictionary

In this procedure, the following terms mean:

Baseline emissions	The emissions measured from an unmodified vehicle or engine operating on the fuel type it was originally design.
Baseline test	An emissions test of a motor vehicle or a motor vehicle engine in a proper state of maintenance prior to any modifications necessary to operate on the alternate fuel or powertrain system.
Conformity factor	The factor applied to the relevant emission limit to account for variation likely under real world emissions measurement.
PEMS	Portable emissions measurement system.
Portable emissions measurement system	The meaning given by UNECE Regulation No. 49 Revision 6.
Proper state of maintenance	All engine and emissions systems are within the mileage and age limits specified under ADR 80/.. for durability of emission control systems, functioning as designed, and no known engine or emissions defects exist. If the vehicle is fitted with OBD, no engine or emissions codes are present.
Relevant standard	The ADR which specified the gaseous emission limits which the vehicle was originally manufactured to comply with.
UN ECE Regulation	An addendum to the United Nations Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts done at Geneva on 20 March 1958