

NATIONAL CODE OF PRACTICE



VSB 6

HEAVY VEHICLE MODIFICATIONS

Section A
Engines

A HEAVY VEHICLE MODIFICATIONS**1. SCOPE**

This section relates to the fitting of replacement engines to heavy vehicles.

It outlines the minimum design and installation requirements for commercial vehicle engine replacement and includes both engines offered as a manufacturer's optional engine and non-standard engines.

Replacement or fitting of engine ancillary equipment, e.g. exhausts and air cleaners, is also covered, as are broad guidelines covering some areas, not usually associated with safety.

Despite adhering to this section, for changes beyond the limits of the vehicle manufacturer's recommendations, may result in other problems arising.

Businesses involved in engine installation are advised to seek direction from the vehicle, engine or system manufacturers or suppliers before finalising selection and configuration.

2. GENERAL INFORMATION

Selection of an alternative engine for a heavy vehicle will usually involve four considerations:

- Engine Type selection of an engine type appropriate to the vehicle and the service conditions for which the vehicle is intended.
- Engine Output which will provide the performance required with acceptable durability.
- Engine Dimensions the suitability of the engine dimensions - for installation in the vehicle.
- Engine Compliance with emission related ADR's.

This section is primarily aimed at addressing compliance with ADR's and other safety issues. However, as guidance to achieving a satisfactory installation, Appendix 1 includes additional information on the other considerations together with installation considerations.

3. ADR's AFFECTED**3.1 ADR's**

Australian Design Rules that may be applicable to commercial vehicle engines are:

ADR 17, 17/..,	<i>Fuel System;</i>
ADR 28/..,83/..,	<i>External Noise of Motor Vehicles;</i>
ADR 30, 30/..,	<i>Diesel Engine Exhaust Smoke Emissions;</i>
ADR 35, 35A, 35/..,	<i>Commercial Vehicle Brake Systems;</i>
ADR 36, 36/..,80/..	<i>Exhaust Emission Control for Heavy Duty Vehicles;</i>
ADR 42/..,	<i>General Safety Requirements;</i>
ADR 44/..,	<i>Specific Purpose Vehicle Requirements</i>

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ADR 65/.., *Maximum Road Speed Limiting for Heavy Goods Vehicles and Heavy Omnibuses.*

ADR 80/..; *Emission Control for Heavy Vehicles (Applicable 1 January 2002).*

4. AFFECTING MODIFICATIONS

The installation of any engine, other than one of the same make, size and model supplied by the manufacturer as original equipment.

5. REQUIREMENTS**5.1 Compliance Requirements**

- When fitted with a replacement engine the vehicle must continue to comply with all ADR's applicable to it at the time of its original manufacture.
- When a pre-ADR vehicle is fitted with an engine manufactured to meet an emission related ADR, then all the emission control devices fitted to the engine must be retained and operate after installation, even though the original design and ADR approval may be related to another vehicle category.
- A diesel engine fitted with a manufacturer's ADR 30 compliance plate satisfies that ADR's requirements. Engines requiring compliance with ADR 30 and not fitted with a compliance plate require testing to demonstrate compliance.
- A replacement engine for all other ADR complied vehicles must have been manufactured for a vehicle that complied with ADR 36/... or ADR 80/.. and must meet or exceed the ADR requirements in force on the manufacture date of the vehicle the engine is being fitted to.
- Where a replacement engine is certified to ADR 80/.. or sourced from an ADR 80/.. compliant vehicle all emission and electronic controls applicable to that engine must be retained and operational. Where data recording capabilities are fitted to the engine they must be retained.
- Except in the case where a manufacturer's optional engine is fitted together with the air induction system and exhaust system originally specified with that engine by the vehicle manufacturer, it will be necessary to certify that the vehicle maintains compliance with ADR 28/.. or ADR 83/.. (see Modification Code A4).

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5.2 Selection and Installation Requirements

It is recommended that any replacement engine should be an optional engine available from the manufacturer for that model vehicle. It should be installed in the same manner as installed by the manufacturer. However, where this is not feasible, the following requirements should be met:

- Any replacement engine should be of similar mass and power output to that of an engine fitted by the original vehicle manufacturer as standard or optional equipment.
- When the replacement engine is heavier than the engines offered by the vehicle manufacturer as optional on the vehicle being modified, the vehicle must be upgraded, e.g. brakes, front axle capacity and suspension capacity as required.
- The power and torque of the replacement engine must not exceed the capacity of the vehicle driveline.
- For a diesel engine, an engine stop control must be installed which will prevent the engine from being started by any accidental or inadvertent means. ADR 42/04 requirements should be followed.
- The replacement engine must permit the vehicle laden to its rated GCM to meet the gradeability requirements of the S3 code in section S of VSB 6.
- If the fitting of the replacement engine requires any frame modifications or rail cut outs that exceed those provided by the manufacturer, then such modifications must be in accordance with Section H - Chassis Frame, of this National Code of Practice. This is particularly relevant when replacing an inline engine with a V configured engine.
- All work must be performed in accordance with recognised engineering standards and to the satisfaction of the certifying officer.
- All components used must be within manufacturer's ratings.
- The replacement engine air compressor or brake system vacuum pump must have sufficient capacity to supply the vehicle's service and parking brake systems, and continue to meet the requirements of all applicable Australian Design Rule requirements.
- Replacement engine mountings should be designed to withstand the torsional loads transmitted by the replacement engine and have the ability to restrict excess engine movement, thus preventing damage to other components e.g. cooling fan, radiator.
- Fuel lines must be well clear of exhaust system and turbochargers.
- Adequate protection from excessive heat should be provided for all hoses, electrical harnesses, rubber or plastic components.
- The air induction and exhaust system must meet the design criteria for the new engine and must meet or exceed the requirements of the ADR's applying to both the engine and the vehicle installation.
- It is recommended that a clearance of at least 10 mm be maintained between engine and chassis/cab components to accommodate engine movement.

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- The replacement engine should be installed in a position and angle that allows the driveline to comply with Section C - Tailshafts of this National Code of Practice.
- All heat and sound insulation material as originally fitted should be either retained or augmented to account for the replacement engine.

6. RECORDING

Appendix 1 gives a set of items that should be considered in evaluating an engine installation. Appendix 2 gives the suggested minimum data that should be recorded for each engine replacement. Where information on the original engine cannot be obtained, then the certifying officer should make an informed estimate of the original values.

Appendices A1 to A5:

- Summarise the scope of modification work which may be certified under each of these Modification Codes;
- Include lists of sections of this National Code of Practice covering other areas of the vehicle which may have been affected by the modification and which should be analysed to determine whether they, too, require re-certification;
- Include checklists appropriate to the particular Modification Codes.

It is suggested that records of analysis work, sketches, vehicle specification data, together with copies of the calculation sheet and completed check lists, be retained by the certifying officer for at least the period specified in Part A of this National Code of Practice.

A HEAVY VEHICLE MODIFICATIONS**Appendix 1****General Information****REPLACEMENT ENGINE SELECTION AND INSTALLATION****1. ENGINE SELECTION****1.1 Engine Type**

There is a wide range of engines available, for example:

- compression ignition (diesel) / spark ignition (petrol);
- high performance design / high endurance design;
- high speed / low speed.

An engine must be selected taking into account its 'real life' service factors, such as:

- the economics of the vehicle operation, such as capitalisation, special vehicle application, service versus replacement costs and annual distance covered;
- the type of operation, such as short or long haul, ratio of average to maximum GVM, high or low average speed and idling time; and
- service conditions, such as road surface and gradients, traffic conditions, climate and service facilities.

1.2 Duty Cycle and Tractive Effort

Truck performance capability formulae, available in engineering publications and also in sales literature used by engine and vehicle manufacturers, can be used to determine the engine performance characteristics required as follows:

- The tractive effort required at a range of vehicle speeds can be determined knowing:
 - the GVM and GCM of the vehicle;
 - gradeability required;
 - startability required;
 - maximum and cruising speeds required.

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By knowing the tractive effort required tyre size and overall torque multiplication ratio through the driveline (including transmission and rear axle), the engine torque and horsepower required at various engine speeds can be obtained and compared with the output curves published by engine manufacturers. In some applications additional output may be required for simultaneous operation of equipment such as power steering, air compressors and air conditioning driven directly from the engine or transmission power take off.

1.4 Engine Dimensions

Using the engine manufacturers published specifications, the selected engine should be checked against the vehicle to ensure that:

- the engine fits into the available space without major frame, cab, or other modifications;
- the engine mass and location of centre of gravity does not result in an unacceptable front axle load; and
- the location of engine ancillaries, such as cooling system intake and exhaust, are suitable in the vehicle environment.

2. ENGINE INSTALLATION**2.1 Engine Mounting**

Factors to be considered when designing engine mounts are:

- Weight Support - design of frame mounting brackets and/or cross members;
- Torsional Restraint - extra support structure may be required;
- Longitudinal Restraint - extra support structure may be required;
- Vibration Isolation - resilient mountings must be tuned to provide acceptable isolation and avoid resonant vibrations;
- Frame Deflection - reinforcement of frame members at mounting points; and
- Drive Line Angularity - the engine location must ensure that the universal joint(s) angles are within the driveline manufacturer's recommendations. Refer Section C - Tailshafts of this National Code of Practice.

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2.2 Engine Ancillaries - General

To achieve safe operation and the expected engine performance in service, the installation must be compatible with the operating environment and interfaces specified by the engine manufacturer. Some of these requirements are summarised in this section. Detailed recommendations and specifications should be obtained from the engine manufacturer.

2.2.1 Air Intake System

An efficient and reliable air intake system is essential for long life and satisfactory engine performance.

- For diesel engines required to comply with ADR 30 or 30/.., the air intake system must be designed so that the initial inlet restriction conforms to the requirement in Australian Design Rule ADR 30 or 30/.., *Diesel Engine Exhaust Smoke Emissions*. The maximum allowable inlet depression under ADR 30 or 30/.. will be available from the engine manufacturer.
- Engine and air cleaner - manufacturers' requirements must be met, and it is recommended that engine and air cleaner suppliers be consulted during development of the system.
- Engine air flow - operating conditions and service intervals must be considered when determining the air cleaner size for any particular installation. Multiple filters and two-stage air cleaner systems may be necessary in high dust concentrations or where extended service intervals are desired. Fitting of an air cleaner service indicator is recommended.
- Air inlet - this should be located to maximise cool air charge and to minimise the ingestion of water from rain and when washing the vehicle. It should not be located near exhaust manifolds or pipes.
- Flexible fittings - these should be incorporated in the system with adequate support to prevent failure due to misalignment, engine movement and vibration. All joints must be airtight.

2.2.2 Exhaust System - General

The exhaust system must be designed to safely disperse the exhaust gases into the atmosphere while not exceeding noise limits set by ADR'S, and the back pressure limit set by the engine manufacturer.

- Back pressure - to minimize back pressure, sharp radius bends and reducers in the pipe run should only be used when their use cannot be avoided.
- Turbocharger housings must not be subjected to excessive weight of the downstream components of the exhaust system. The engine manufacturer's recommendation must be followed.
- Allow for thermal expansion throughout the system.
- Maximum back pressure levels allowed for a diesel engine required to comply with ADR 30 or 30/.., *Diesel Engine Exhaust Smoke Emissions*, should be obtained from the engine manufacturer and adhered to.

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- To ensure that all the above requirements are met, it is recommended that development of the system is carried out in conjunction with both the engine and exhaust system suppliers.
- Exhaust back pressure is measured with the engine operating under rated load conditions. The pressure tap should be made as close as possible to the turbocharger, or exhaust manifold on non-turbocharged engines, and at least 300 mm downstream from a bend.

2.2.3 Exhaust Pipe Location

- The exhaust pipe should not be under fuel tanks or fillers.
- The exhaust outlet should be directed away from driver/operator and engine air inlet and cooling systems.
- Water should be prevented from entering the exhaust outlet.
- Location of the exhaust outlet must conform to the requirements of Australian Design Rule ADR 42/...
- In the case of special vehicles such as tankers and omnibuses, the exhaust location must conform to the requirements of ADRs and other applicable Australian Standards.

2.2.4 Fuel System

Engine manufacturers' specific requirements for the fuel system must be adhered to.

- Fuel pump requirements as specified by the engine manufacturer must be adhered to for all ADR certified engines, if applicable.
- Fuel supply line to the engine must be of the size and quality required for the engine installation and its fuel.
- Liquefied Petroleum Gas (LPG) fuelled vehicles must comply with the requirements of ADR 44/.., *Specific Purpose Vehicle Requirements and the SAA Automotive LP Gas Code AS1425*. Compressed Natural Gas (CNG) fuelled vehicles must comply with the requirements of AS/NZS 2739:2009 - Natural gas (NG) fuel systems for vehicle engines.

Where diesel engines are converted to operate on an alternative fuel other than LPG in a single fuel, multi simultaneous fuels or dual fuel mode the completed vehicle must be tested to the requirements of DT80 Emission Rates: *Road Transport Reform (Vehicle Standards) Amendment Regulations 2001*. Where conversions are performed on multiple vehicles it is sufficient to hold a satisfactory DT 80 test result for one vehicle where the following circumstances apply:

- All vehicles are fitted with the same make and model engine
- The conversion equipment is identical on all engines
- Air inlet and filtration is identical on all engines
- The DT 80 test results document all applicable information from the test vehicle

2.2.5 Cooling System

The cooling system must meet the requirements laid down by the engine manufacturer. The development of the total cooling system to suit the engine/vehicle combination will involve many factors

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including careful selection of the main units - the radiator, fan, shroud etc. to obtain a balanced, trouble-free system. This should be done in conjunction with engine, radiator and fan suppliers. Some of the factors that must be considered are listed below:

- The system should provide a sufficient head of water on the coolant pump inlet to prevent cavitation. This may be achieved by arranging for the coolant level in the reservoir to be higher than the highest point in the engine galleries including the pump.
- Radiator inlet/outlet diameter should not be less than the engine inlet/outlet diameters. Avoid causes of high restriction on the pump suction inlet.
- The specific coolant filling requirements of the engine manufacturer must be adhered to.
- Piping between the radiator and the engine should allow for engine/vehicle movement and ease of installation.
- Piping should be supported where necessary to avoid excessive loads being placed on hose/piping connections and to minimise vibration.
- Kinking of piping must be avoided.
- Cooling fans absorb a significant amount of power and can create a high noise level. As a general rule, a larger fan, turning at the slowest speed to achieve the required air flow, should be used. It is recommended that a specialist fan supplier be consulted.

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Appendix 2

Modification Report - Engine Installation

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Appendix A1

Modification Code A1

ENGINE SUBSTITUTION

Modifications that are covered under this Modification Code are:

1. Fitting of a replacement engine of similar mass and power output to that offered by the first manufacturer;
2. Re-rating existing engines; and
3. Conversion from petrol engine to diesel and vice versa.

Modifications that are **not** covered under this Modification Code are:

1. Fitting of replacement engine that does not comply with applicable ADR's, unless being fitted to a pre-ADR vehicle;
2. Fitting of replacement engine whose power, torque or mass are not compatible with the existing components of the vehicle, unless the affected systems are upgraded at the same time; and
3. Fitting of replacement engine that necessitates substantial modification to a vehicle's chassis, unless modifications complying with Section H of this National Code of Practice are carried out at the same time.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification testing, and/or data to show continuing compliance of the modified vehicle.

DETAIL	REQUIREMENTS
Engine mountings	Good engineering practice
Radiator mounting	Good engineering practice
Air induction/air cleaner	Modification Code A2
Exhaust	Modification Code A4
Noise	ADR 28/.., ADR83/..
Brake system - compressor recharge	ADR 35, 35A, 35/.. (Sections relating to "Special Provisions for Systems Using 'Stored Energy' (except Spring Brake Systems'"))
- vacuum recharge	ADR 35, 35A, 35/.. (Sections relating to "Special Provisions for Systems Using 'Stored Energy' (except Spring Brake Systems'"))
Cabin modifications	Modification Code K4

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Chassis modifications	Modification Code H5
Steering	Modification Code E2
Emissions	
- diesel	ADR 30/., 80/..
- petrol	ADR 36/., 80/..

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Checklist A1

ENGINE SUBSTITUTION

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Appendix A2

Modification Code A2

AIR CLEANER SUBSTITUTION OR ADDITIONAL FITTING

Modifications that are covered under this Modification Code are:

1. Fitting of an additional air cleaner;
2. Fitting of an alternative air cleaner;
3. Repositioning of air cleaner;
4. Removal of air cleaner (on multi air cleaner systems only);

Note: An appropriately sized air cleaner must always be incorporated into a vehicle induction system.

5. Reposition of induction pipes.

Modifications that are **not** covered under this Modification Code are:

1. Elimination of air cleaner; and
2. Fitting of air cleaner which invalidates compliance with ADR's.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards and Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and which may require recertification testing and/or data to show continuing compliance of the modified vehicle.

DETAIL**REQUIREMENTS**

Fitting/removal of air cleaner

ADR 28/..; 83/.. ADR 30/..; ADR 36/.., 80/.. ADR 44/.., AS 2739.

Good engineering practice

Refer Appendix A4 for Checklist.

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Appendix A3

Modification Code A3

TURBOCHARGER INSTALLATION

Modifications that are covered under this Modification Code are:

1. Fitting of turbocharger to diesel engine; and
2. Fitting of air intercooler (after-cooler) to a turbocharged diesel engine.

Modifications that are **not** covered under this Modification Code are:

1. Fitting of turbocharger to engine which contravenes any ADR's; and
2. Fitting of turbocharger to engine which results in the power/torque output of the engine not being compatible with the original vehicle componentry.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards and Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance of the modified vehicle.

DETAIL	REQUIREMENTS
Substitute manifolds	Good engineering practice
Substitute air cleaner	Modification Code A2
Fit oil lines	Good engineering practice
Fit turbocharger	Good engineering practice
Adjust fuel pump	ADR 30/.. ADR 80/.. Good engineering practice
Replace injectors	ADR 30/., ADR 80/... Good engineering practice
Substitute exhaust	Modification Code A4
Noise	ADR 28/.., ADR 83/..

Refer Appendix A4 for Checklist.

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Appendix A4

Modification Code A4

EXHAUST SYSTEM ALTERATION

Modifications that are covered under this Modification Code are:

1. Re-routing, lengthening or shortening of exhaust system;
2. Fitting of alternative mufflers;
3. Fitting of alternative exhaust systems; and
4. Relocation of exhaust outlets.

Modifications that are **not** covered under this Modification Code are:

1. Removal of a muffler(s);
2. Fitting of exhaust components which will contravene compliance with ADR 28, ADR 28/... or ADR 83/...; and
3. Modification of other than heavy vehicles.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards and Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification testing and/or data to show continuing compliance of the modified vehicle.

DETAIL

ADR28/.., ADR 83/.. specifications for pipe diameter, length, routing, outlet position and type and quantity of muffler(s)

REQUIREMENTS

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Checklist A4

**AIR CLEANER SUBSTITUTION OR ADDITIONAL FITTING
TURBOCHARGER INSTALLATION
AIR CLEANER/TURBO CHARGER INSTALLATION/
EXHAUST SYSTEM ALTERATION**

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Appendix A5

Modification Code A5

ROAD SPEED LIMITER INSTALLATION

Modifications that are covered under this Modification Code are:

1. The installation of an approved road speed governor system*.
2. Calibration, certification and sealing of road speed governor systems.
3. Certification that a vehicle is road speed limited in accordance with the technical requirements of Vehicle Standards Bulletin VSB2 *'Maximum Road Speed Limiting for Heavy Trucks and Buses'* issued by the Federal Office of Road Safety.

Modifications that are **not** covered under this Modification Code are:

1. Fitting of non approved road speed governors.
2. Fitting of systems that are not compatible with the existing vehicle components.
3. Modification of other than heavy vehicles.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards and Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance of the modified vehicle.

DETAIL	REQUIREMENTS
Performance of Road Speed Limiter	ADR 65/..

*Special Note - Approved Road Speed Governors

Road speed governors which comply with the requirements of ADR 65/.. or BS AU 217: Part 1 1987 *'Maximum Road Speed Limiters for Motor Vehicles'* are considered to be 'approved road speed governors'. Certifying officers should determine from the supplier of the road speed governor that it meets one of these standards and should ensure that it is installed in accordance with the manufacturer's recommendations.

A HEAVY VEHICLE MODIFICATIONS**ROAD SPEED LIMITER INSTALLATION****SPECIFIC REQUIREMENTS****1. GENERAL**

The maximum road speed of heavy goods and heavy omnibus vehicles may be limited in these ways:
GEARED SPEED CONTROL - The vehicle's overall gearing is specified so that at rated engine RPM, the vehicle is incapable of exceeding the applicable 'Maximum Road Speed Capability'.

ROAD SPEED GOVERNOR - A mechanism which in response to a signal from a sender measuring the vehicle's road speed controls the engine's RPM to limit maximum road speed to no more than the applicable 'Maximum Road Speed Capability'.

INSUFFICIENT ENGINE POWER - A vehicle is considered to be speed limited if it has insufficient engine power to exceed the applicable 'Maximum Road Speed Capability'.

2. APPLICABILITY

- All ME and NC category vehicles with dates of manufacture as defined in ADR 65/..;
- All other vehicles covered by ADR 65/..;
- Vehicles in service as specified by registering authorities.

3. MAXIMUM ROAD SPEED CAPABILITY

- For a hauling vehicle designed for use in a 'road train' the maximum road speed capability shall be no greater than that determined by the appropriate State Territory or National authority.
- For other heavy goods vehicles and heavy omnibuses the maximum road speed capability shall be no greater than that specified in ADR65/...

4. TESTING

- The procedure in ADR 65/.. applies to new vehicles.
- Vehicles in service, either those covered by ADR 65/.. and subsequently modified, or those not subject to ADR 65/.. and subsequently fitted with a road speed limiter, may be tested in accordance with:
 - ADR 65/.. procedures; or
 - The abridged test procedure in paragraph 5.

A HEAVY VEHICLE MODIFICATIONS**5. ABRIDGED TEST OF ROAD SPEED LIMITATION****5.1 Test Conditions**

- The settings of the test vehicle including fuel feed, wheels and tyres and transmission shall conform to the manufacturer's specifications.
- The tyres shall be bedded and the pressures shall be as specified by the manufacturer.
- The vehicle shall be in unladen condition.

5.2 Verification of Rated Engine Speed

The 'Rated Engine Speed' is defined as the speed above which the engine governing system beginning to substantially reduce power.

The rated engine speed is initially set by the engine manufacturer however for various reasons this may have altered in service.

It is therefore necessary to verify the 'Rated Engine Speed' using a chassis dynamometer or by means of a physical test as follows:

- Check the accuracy of the vehicles tachometer against a calibrated hand held tachometer. (Note: Optical tachometers may be calibrated against any fluorescent light. Fluorescent lights have an operating frequency of 6000 cycles per minute).
- The vehicle should be driven briefly to determine the maximum engine RPM under load which is the 'Rated Engine Speed'. Note the vehicle tachometer reading must be corrected as necessary using the results from the calibration check conducted earlier to obtain the true 'Rated Engine Speed'.
- In the case of vehicles where the maximum road speed capability is determined by gearing, the 'Rated Engine Speed' must be stamped on the Modification Plate and indicated on the Certificate of Inspection.

5.3 Speedometer Accuracy

The accuracy of the vehicle's speedometer must be verified. This can be done using a chassis dynamometer or by employing a qualified instrument servicing organisation.

5.4 Road Test

The vehicle must be tested in both directions over a section of road, substantially level for a minimum distance of 1.6 km, with the accelerator fully applied for the entire distance of each test.

- Where speed is limited by insufficient power, the vehicle must be travelling at 90 km/h at the beginning of the test. If 90 km/h is not attainable, at not less than 90% of its true maximum speed, at the start of the 1.6 km section. The vehicle's true speed in any gear must not exceed 100 km/h at the termination of either of the tests in opposite directions.

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- Where speed is limited by gearing, the test should be similar. In some cases, because the vehicle is unladen for this test, the engine will not be operating under high load conditions. In these cases it is normal for the engine RPM to exceed its rated engine speed because of what is termed 'governor droop'. In such cases, it is acceptable to test the vehicle with the engine RPM held to the rated engine speed (see section above for details of how to verify rated engine speed and how to calibrate the vehicle's tachometer).
- For vehicles fitted with an 'Approved Road Speed Governor', the test should be similar, except that a brief initial overshoot is permitted, to 105% of the limited speed (i.e. to 105 km/h). Subsequently, the speed must average 100 km/h or the set speed, with cycle peaks not exceeding 103 km/h for the remainder of the test.

Note - A chassis dynamometer may be used to replicate the test conditions in lieu of a road test. Speed limits for Road Trains and other multi combinations vary in different States and Territories check requirements before commencing adjustments.

6. CERTIFICATION

For mechanical governor systems the following parts shall be fitted with a lead seal, bearing the authorised officer's number as identification, to indicate if the component has been tampered with:

- The governor road speed adjustment mechanism.
- The two ends of the link between the road speed limiter and the injection pump.
- The two ends of the link between the road speed limiter and the device providing the road speed signal.
- All internal parts of the road speed limiting equipment shall be made resistant to tampering by means of casings capable of being sealed.

The control unit, in the case of an electronic road speed governor, shall be sealed and suitably marked with the authorised officer's number to prevent unauthorised entry into the box containing the electronic control circuitry.

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Checklist A5

ROAD SPEED LIMITER INSTALLATION