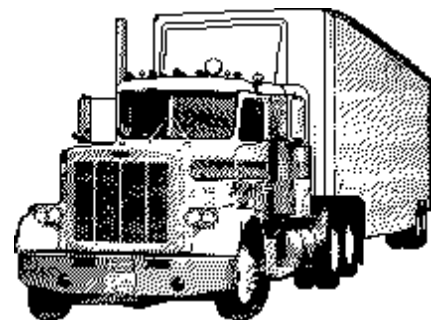
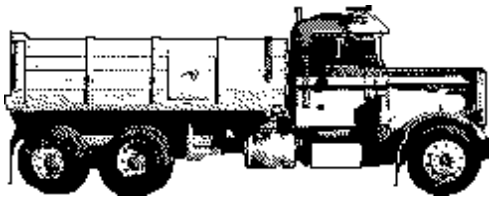


Section A  
**ENGINES**



**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.

Adherence to this section, for changes beyond the limits of the vehicle manufacturer's recommendations, does not ensure that other problems will not arise.

Companies involved with engine installations are advised to seek direction from the vehicle, engine or system manufacturer or supplier before finalising design choices.

**2. GENERAL INFORMATION**

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

- selection of an engine type from the range of available engines appropriate to the vehicle and the service conditions for which the vehicle is intended.
- selection of an engine with required output which will provide the vehicle performance required with acceptable durability.
- evaluation of the suitability of the engine dimensions - for installation in the vehicle.
- compliance with 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, 28A, 28/...	<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/...	<i>Exhaust Emission Control for Heavy Duty Vehicles;</i>
ADR 42/...	<i>General Safety Requirements;</i>

**HEAVY VEHICLE MODIFICATIONS**

ADR 44/...	<i>Specific Purpose Vehicle Requirements</i>
ADR 65/..,	<i>Maximum Road Speed Limiting for Heavy Goods Vehicles and Heavy Omnibuses.</i>
ADR 70/...	<i>Exhaust Emission Control for Diesel Engines.</i>
ADR 80/..;	<i>Emission Control for Heavy Vehicles (Applicable 1 January 2002).</i>

**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**

- Replacement engines must, as a minimum, comply with all ADR's applicable to that category of vehicle at the time that the original vehicle was manufactured.
- When a vehicle which is pre-ADR is fitted with an engine to which ADR's applied, then all anti-pollution devices fitted to the engine must be retained and operate after installation, even though the original ADR approval may have applied to another 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.
- If a petrol engine, the replacement engine must have been manufactured for a vehicle that complied with ADR 36 or 36/...
- 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 28/.. (see Modification Code A4).

**5.2 Installation Requirements**

It is recommended that any replacement engine should be an optional engine available from, and installed in the same manner as that by, the manufacturer for that model vehicle. 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 larger than an engine offered by the vehicle manufacturer as optional equipment on the vehicle being modified, the vehicle must be equipped with any necessary upgrading of equipment, e.g. brakes, front axle capacity and suspension capacity.
- The power and/or torque of the replacement engine must not exceed the capacity of the vehicle driveline.

**HEAVY VEHICLE MODIFICATIONS**

- 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.
- The replacement engine must have the performance ability that will permit the vehicle, when laden to its rated GCM, to start from rest on a 13 per cent gradient.
- 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 a six cylinder inline engine with a V8 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 brake compressor or 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 ADR's.
- 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 should meet the same design criteria as the original engine installation.
- It is recommended that a clearance of at least 10mm be maintained between engine and chassis/cab components to accommodate engine movement.
- 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 retained.

**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.

Appendixes A1 to A5:

- summarise the scope of modification work which may be certified under each of these Modification Codes;

**HEAVY VEHICLE MODIFICATIONS**

- 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 check lists appropriate to the particular Modification Codes, which should be completed.

It is suggested that analysis work records, sketches and other vehicle 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.

**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:

- diesel/petrol;
- high performance/conservative design;
- high revving/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 Engine Output**

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 of the vehicle;
  - gradeability required;
  - gradient 'startability' required;
  - maximum and cruising speeds required.

**1.3 Horsepower and Torque**

By knowing the tractive effort required, tyre size and overall torque multiplication ratio through the 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.

**HEAVY VEHICLE MODIFICATIONS**

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:

- mass 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.

**2.2 Engine Ancillaries - General**

To achieve safe operation and the in-service engine performance expected from the engine performance/applications analysis, the installation must comply with the operating system requirements laid down by the engine manufacturer. Some of the essential needs of the various systems are summarised in this section. Detailed recommendations and specifications should be obtained from the engine manufacturer.

**2.3 Air Intake System**

An efficient and reliable air intake system is essential if long life and satisfactory engine performance are to be assured.

**HEAVY VEHICLE MODIFICATIONS**

- 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 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.
- Intake system inlet - this should be located to maximise cool air input 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.

**2.4 Exhaust System - General**

The exhaust system must be designed to safely disperse the exhaust fumes into the atmosphere at a noise level not exceeding that specified by Australian Motor Vehicle Standards, and without creating back pressure in the system, which could unduly prejudice engine output.

- Back pressure - to achieve engine manufacturer's specifications short radius bends and reducers in the pipe run should only be used when their use cannot be avoided.
- Turbocharger housings must not be used to support significant exhaust system mass. 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.
- 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.

**2.5 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.

**HEAVY VEHICLE MODIFICATIONS**

- Water should be prevented from entering the exhaust outlet.
- Location of the exhaust outlet must conform to the requirements of ADR 42/...
- In the case of special vehicles such as tankers and omnibuses, the exhaust location must conform to the requirements of other Australian Motor Vehicle Standards such as those issued by Standards Australia.

**2.6 Fuel System**

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

- Fuel systems for category NB vehicles built after 1975 must comply with ADR 17 or 17/..., *Fuel System*.
- 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*. Compressed Natural Gas (CNG) fuelled vehicles must comply with the requirements of AS 2739 - Natural gas (CNG) fuel systems for vehicle engines.**

**2.7 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 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.

**HEAVY VEHICLE MODIFICATIONS**

- 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.

## HEAVY VEHICLE MODIFICATIONS

## Appendix 2

Modification Report – Engine Installation

Report No.

Vehicle Make & Model		Body Type
Engine	Original	New
Make		
Model		
Cub. capacity		
Power kW @ RPM		
Torque Nm @ RPM		
ADR 30 comp		
ADR 36 comp		
Driveline	Original	New
Transmission input torque capacity		
Driveline angularity (degrees in vertical plane)		
Driveline shaft size outside diameter		
Universal joint (yoke size)		
Rear axle load capacity		
Operating Characteristics	Original	New
Trans ratio – 1 <sup>st</sup>		
Trans ratio – top		
Rear axle ratio(s)		
Tyre size		
Max road speed		
Max tractive effort		
Air comp capacity or vacuum level at idle		
Vehicle	Original	New
Front axle load		
GVM / GCM		
ADR 17 comp		
ADR 28/.. comp		
ADR 30 comp		
ADR 36 comp		
Engine to chassis/body component clearances		
Engine to chassis/body heat & vibration effects		

Signed: \_\_\_\_\_ Date: \_\_\_\_\_ Res. No. \_\_\_\_\_

**HEAVY VEHICLE MODIFICATIONS****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, or fitting of a replacement engine whose power, torque or mass are compatible with the existing components of the vehicle; 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 for the modified vehicle.

<b>DETAIL</b>	<b>REQUIREMENTS</b>
Engine mountings	Good engineering practice
Radiator mounting	Good engineering practice
Air induction/air cleaner	Modification Code A2
Exhaust	Modification Code A4
Noise	ADR 28, 28A, 28/..

## HEAVY VEHICLE MODIFICATIONS

Brake system - compressor recharge	ADR 35, 35A, 35/.. (Sections relating to “Special Provisions for Systems Using ‘ <i>Stored Energy</i> ’ (except <i>Spring Brake Systems</i> ’))
- vacuum recharge	ADR 35, 35A, 35/.. (Sections relating to “Special Provisions for Systems Using ‘ <i>Stored Energy</i> ’ (except <i>Spring Brake Systems</i> ’))
Cabin modifications	Modification Code K4
Chassis modifications	Modification Code H5
Steering	Modification Code E2
Emissions - diesel	ADR 30, 30/..
- petrol	ADR 36, 36A, 36/..

## HEAVY VEHICLE MODIFICATIONS

## Checklist A1

## ENGINE SUBSTITUTION

(Y=Yes N=No)  
delete if not applicable**1.0 Frame**

- |     |  |   |   |
|-----|--|---|---|
| 1.1 | Do frame rail cut outs satisfy either the manufacturer's recommendations or those outlined in Section H of this National Code of Practice? | Y | N |
| 1.2 | Have all cross members that have been removed been replaced?   | Y | N |

**2.0 Engine**

- |      |  |   |   |
|------|--|---|---|
| 2.1  | Does the engine air induction and exhaust system meet the same design criteria as the original engine installation?  | Y | N |
| 2.2  | Does the brake air compressor or the vacuum supply meet the required performance for ADR 35 (Sections relating to "Special Provisions for Systems Using 'Stored Energy' (except <i>Spring Brake Systems</i> )")? | Y | N |
| 2.3  | Has adequate protection been provided for all hoses, electrical harnesses, rubber or plastic components?   | Y | N |
| 2.4  | Are fuel lines secure and clear of the exhaust system and turbocharger?  | Y | N |
| 2.5  | Does the engine installation comply with all applicable ADR's (i.e. smoke, noise etc.)?  | Y | N |
| 2.6  | Is all heat and sound insulation as originally fitted retained?  | Y | N |
| 2.7  | Is a diesel engine stop control fitted which will prevent accidental or inadvertent starting? (Applicable to diesel engines only.)   | Y | N |
| 2.8  | Are the engine mountings designed to withstand the torsional loads transmitted by the replacement engine?  | Y | N |
| 2.9  | Does the engine have adequate clearance between axle, chassis and cab?   | Y | N |
| 2.10 | Does the replacement engine have the performance requirements to permit the vehicle when laden to its rated GCM to start from rest on a 13 per cent gradient?  | Y | N |
- 3.0 General**
- |     |  |   |   |
|-----|--|---|---|
| 3.1 | Is the quality of work to a satisfactory standard? | Y | N |
|-----|--|---|---|

NOTE: If the answer to any relevant question is "NO", the modification is not acceptable.

**HEAVY VEHICLE MODIFICATIONS**

Vehicle Chassis No/VIN: .....

Vehicle Modifier: .....

Examined by: .....

Company (if applicable):.....

Certifying Officer No:.....Modification Certificate No:.....

Modification Plate No:.....

Signed:..... Date:.....

## HEAVY VEHICLE MODIFICATIONS

## 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 or 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 for the modified vehicle.

**DETAIL**

Fitting/removal of air cleaner

**REQUIREMENTS**

ADR 28, 28A, 28/..; ADR 30, 30/..; ADR 36, 36A, 36/.., ADR 44/.., AS 2739.

Good engineering practice

**Refer Appendix A4 for Checklist.**

## HEAVY VEHICLE MODIFICATIONS

## 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 (aftercooler) 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 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 compliance for 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, 30/.. Good engineering practice
Replace injectors	ADR 30, 30/.. Good engineering practice
Substitute exhaust	Modification Code A4
Noise	ADR 28, 28A, 28/..

**Refer Appendix A4 for Checklist.**

**HEAVY VEHICLE MODIFICATIONS**

**Appendix A4**

**Modification Code A4**

**EXHAUST SYSTEM ALTERATION**

The limitations of 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; and
3. Modification of other than commercial vehicles.

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 for the modified vehicle.

**DETAIL**

Changes from manufacturer's specifications for pipe diameter, length, routing, outlet position and type and quantity of muffler(s)

**REQUIREMENTS**

ADR 28, 28A, 28/..  
National Code of Practice

## HEAVY VEHICLE MODIFICATIONS

## Checklist A4

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

(Y=Yes N=No)  
delete if not applicable

**1.0 Air Cleaner**

- |     |   |   |   |
|-----|---|---|---|
| 1.1 | Is the additional or alternative air cleaner assembly incorporated into the engine induction system of an appropriate size? | Y | N |
| 1.2 | Does the engine air induction system meet the same design criteria as the original engine installation?                     | Y | N |

**2.0 Turbo Charger Installation**

- |     |   |   |   |
|-----|---|---|---|
| 2.1 | Does the engine air induction and exhaust system meet the same design criteria as the original installation?  | Y | N |
| 2.2 | Has adequate protection been provided for all hoses, electrical harnesses, rubber or plastic components?  | Y | N |
| 2.3 | Are fuel lines secure and clear of the exhaust and turbocharger systems?  | Y | N |
| 2.4 | Has the installation of the turbo charger assembly resulted in the power/torque output of the engine not being compatible with the vehicle drive train? | Y | N |
| 2.5 | Is all heat and sound insulation as originally fitted retained?   | Y | N |

**3.0 Exhaust System Alteration**

- |     |   |   |   |
|-----|---|---|---|
| 3.1 | Does the exhaust system alteration comply with all applicable ADR's (i.e. smoke, noise etc.)?   | Y | N |
| 3.2 | Is the location of the exhaust outlet/s in accordance with ADR requirements?  | Y | N |
| 3.3 | Has adequate protection been provided (where applicable) for all hoses, electrical harnesses, rubber, plastic components or personal contact? | Y | N |
| 3.4 | Are fuel lines secure and clear of the exhaust system?  | Y | N |

**4.0 General**

- |     |  |   |   |
|-----|--|---|---|
| 4.1 | Is the quality of work to a satisfactory standard? | Y | N |
|-----|--|---|---|

NOTE: If the answer to any relevant question is "NO", the modification is not acceptable.

**HEAVY VEHICLE MODIFICATIONS**

Vehicle Chassis No/VIN: .....

Vehicle Modifier: .....

Examined by: .....

Company (if applicable):.....

Certifying Officer No:..... Modification Certificate No:.....

Modification Plate No:.....

Signed:..... Date:.....

## HEAVY VEHICLE MODIFICATIONS

## 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 DoTRS.

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 commercial vehicles.

**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 compliance for the modified vehicle.

**DETAIL****REQUIREMENTS**

Performance of Road Speed Limiter

ADR 65/..

\* Special Note - Approved Road Speed Governors

Road speed governors that 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.

**HEAVY VEHICLE MODIFICATIONS**  
**ROAD SPEED LIMITER INSTALLATION**  
**SPECIFIC REQUIREMENTS**

**1. GENERAL**

The maximum road speed of commercial 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 class vehicles with dates of manufacture as defined in ADR 65/..;
- All other vehicles covered by ADR 65/..;
- Vehicles in service as specified by State or Territory 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 or Territory authority.
- For other heavy goods vehicles and heavy omnibuses the maximum road speed capability shall be no greater than 100 km/h.

**4. TESTING**

- The procedures in ADR 65/.. apply 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.

**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.

**HEAVY VEHICLE MODIFICATIONS**

- The tyres shall be bedded and the pressures shall be as specified by the manufacturer.
- The vehicle shall be at 'Unladen Mass'.
- The vehicle must be roadworthy and must be fully registered or operating under a dealer's plate or permit.

**5.2 Test Procedure Verification of Rated Engine Speed**

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

The rated engine speed is initially set by the engine manufacturer but for any number of reasons this may be altered during the life of a vehicle.

It is therefore necessary to determine 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 or, if not attainable, at not less than 90% of its 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.
- Where speed is limited by gearing, the test should be similar, except that, for a road train vehicle, the starting speed should be 72 km/h and the terminal speed must not exceed 80 km/h. 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).

**HEAVY VEHICLE MODIFICATIONS**

- 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 or 94 km/h for road train vehicles). Subsequently, the speed must average 100 km/h or the set speed, with cycle peaks not exceeding 103 km/h (or 93 km/h for road train vehicles), for the remainder of the test.

Note - A chassis dynamometer may be used to replicate the test conditions in lieu of a road test.

6. CERTIFICATION

For mechanical governor systems the following parts shall be fitted with a lead seal, bearing the certifying 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 Certifying Officer's number to prevent unauthorised entry into the box containing the electronic control circuitry.

In the case of Hauling Units intended for use in road trains, the plate should be marked A5-R-90 to indicate that the vehicle is road speed limited to 90km/h.

## HEAVY VEHICLE MODIFICATIONS

## Checklist A5

## ROAD SPEED LIMITER INSTALLATION

## VEHICLE

MAKE.....MODEL.....

VIN.....REG NO.....

REAR AXLE RATIO.....

TRANSMISSION RATIO IN HIGHEST GEAR.....

TYRE SIZE.....

## METHOD OF SPEED LIMITING

ROAD SPEED GOVERNOR

GEARED SPEED CONTROL

ENGINE POWER

## ROAD SPEED GOVERNORS (if applicable)

MAKE.....

MODEL.....

SERIAL NO.....

Has the supplier provided advice that the road speed governor complies with the requirements of ADR 65/.. or BS AU 217:1987?

Y N

Has the road speed governor been installed in accordance with the manufacturer's recommendations?

Y N

Is the maximum road speed setting prevented from being temporarily increased or removed?

Y N

Is the operation of the road speed governor completely independent of the vehicle's braking system?

Y N

Are **all** components necessary for the full function of the road speed governor energised whenever the vehicle is driven?

Y N

Are **all** of the following parts fitted with a lead seal to indicate any attempt to tamper with the operation of the road speed governor:

- 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;
- the control unit in the case of an electronic road speed?

Y N

HEAVY VEHICLE MODIFICATIONS

GEARED SPEED CONTROL (if applicable)

RATED ENGINE SPEED (L) .....RPM

REAR AXLE RATIO .....

TRANSMISSION RATIO IN HIGHEST GEAR .....

OVERALL GEAR REDUCTION RATIO (A) .....

TYRE SIZE .....

TYRE REVOLUTIONS PER KILOMETRE (M).....REV/KM

CALCULATED MAXIMUM ROAD SPEED CAPABILITY .....KM/H

ROAD TEST

Has the accuracy of the speedometer been checked? Y N

Actual speedo reading at true 100 km/h (90 km/h for road trains) ..... KM/H

Maximum true vehicle speed during test. TEST 1.....KM/H TEST 2 ..... KM/H

Was the vehicle tested and were the results obtained in accordance with ADR 65/.. or Paragraph 5 of this Section? Y N

TEST USING A DYNAMOMETER

Have the dynamometer been calibrated in the past six (6) months? Y N

Date of Calibration...../...../.....

Was the dynamometer set up to simulate the test conditions as outlined in ADR 65/.. or Paragraph 5 of this Section? Y N

Maximum vehicle speed reading. ....KM/H

NOTE: If answer to any question is "NO", the modification is not acceptable.

Vehicle Chassis No/VIN: .....

Vehicle Modifier: .....

Examined by: .....

Company (if applicable):.....

Certifying Officer No:.....Modification Certificate No:.....

Modification Plate No:.....

Signed:..... Date:.....