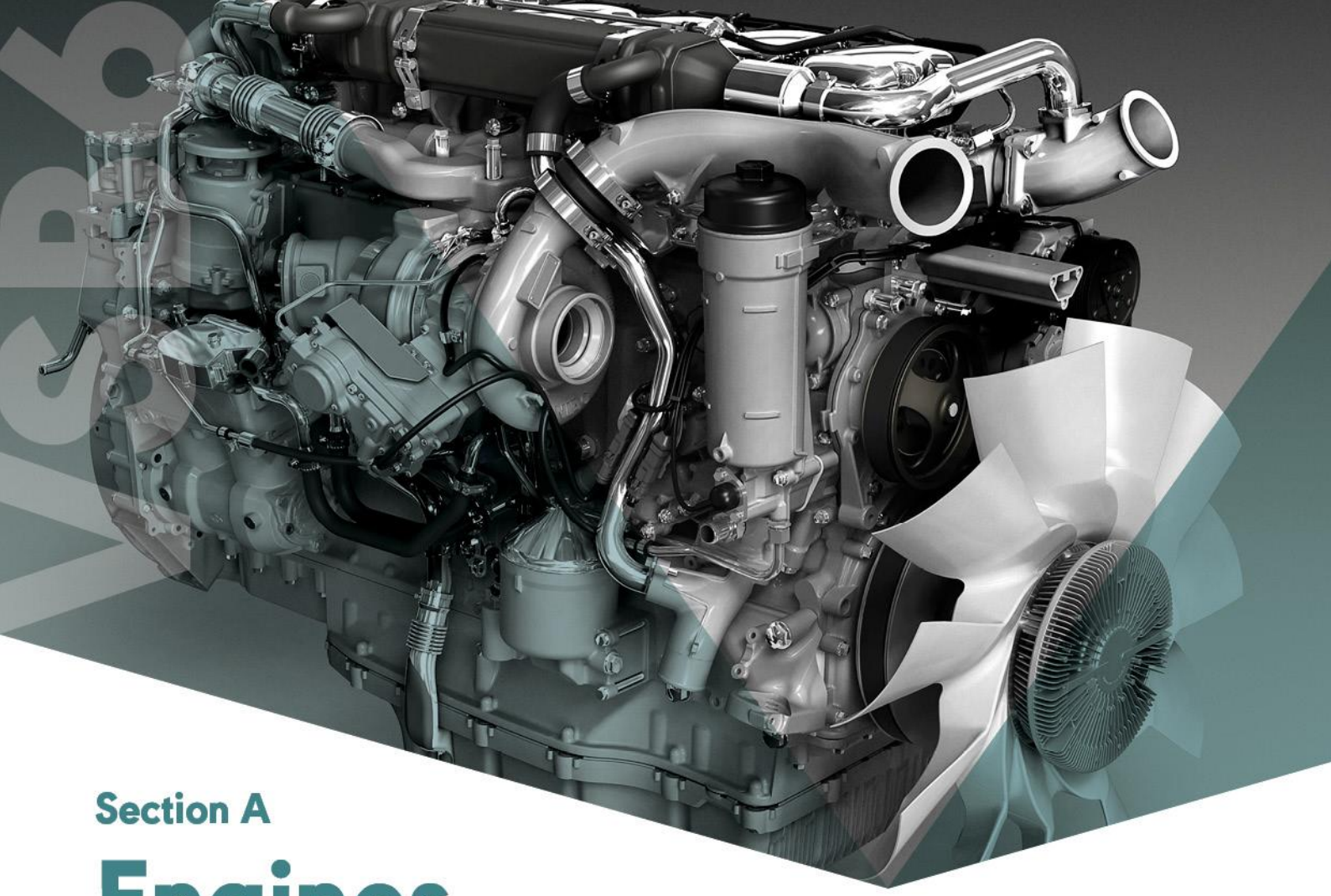

Section A
Engines

Contents

Section A — Overview

1. Description

This section of Vehicle Standards Bulletin 6 (VSB6) relates to the modification of the engine system(s) and the installation of replacement engines to heavy vehicles. The section applies to the installation of any engine or engine system, other than an original manufacturer supplied like-for-like engine and consists of the following modification codes:

A1	**Engine substitution to heavy motor vehicles** • fitting of a replacement engine of similar mass and power output to that offered by the first manufacturer • re-rating existing engines • conversion from petrol engine to diesel and vice versa.
A2	**Air cleaner substitution or the fitting of an additional air cleaner** • fitting of an additional air cleaner • fitting of an alternative air cleaner • repositioning of an air cleaner • repositioning of induction pipes • removal of an air cleaner (on multi-air cleaner systems only).
A3	**Turbocharger installation** • fitting of a turbocharger to a diesel engine • fitting of an intercooler (after-cooler) to a turbocharged diesel engine.
A4	**Exhaust system alteration** • re-routing, lengthening, or shortening of exhaust system • fitting of alternative mufflers • fitting of alternative exhaust systems • relocation of exhaust outlets.
A5	**Road speed limiter installation** • the installation of an approved road speed governor system • calibration, certification and sealing of road speed governor systems.

2. Related Australian Design Rules

The Australian Design Rules (ADRs) relevant to this section include:

ADR no.	Title
17, 17/..	Fuel System
28/.., 83/..	External Noise of Motor Vehicles
30, 30/..	Smoke Emission Control for Diesel Vehicles
35, 35A, 35/..	Commercial Vehicle Brake Systems
36, 36/.., 70/.., 80/..	Emission Control for Heavy Vehicles
42/..	General Safety Requirements
44/..	Specific Purpose Vehicle Requirements
65/..	Maximum Road Speed Limiting for Heavy Goods Vehicles and Heavy Omnibuses

3. Record keeping

The person responsible for certifying the modification should:

- collate complete records, including drawings, calculations, test results and copies of the appropriate issue of Australian Standards and ADRs
- retain the records for a minimum of seven years after commissioning of the modified vehicle
- make the records available upon request for inspection by officers of the relevant federal, state or territory authority or heavy vehicle regulator.

Reports and checklists

The person responsible for certifying the modification must complete and record the following reports and checklists as applicable:

A1 Modification report	Engine installation
A1 Checklist	Engine substitution
A2 Checklist	Air cleaner substitution or additional fitting
A3 Checklist	Turbocharger installation
A4 Checklist	Exhaust system alteration
A5 Checklist	Road speed limiter installation

4. Design requirements

Advanced braking systems

Advanced braking systems are an important safety feature fitted to many new vehicles.

Advanced braking systems are programmed by the vehicle manufacturer and are specific to the vehicle to which they are fitted. Changes made to the vehicle, such as engine, tyre size, steering control, suspension characteristics, vehicle mass and its distribution, may impact the performance of the advanced braking system.

Exercise extra caution when modifying vehicles fitted with advanced braking systems. Electric braking systems may be known as:

- electronic stability control (ESC)
- electronic stability program (ESP)
- vehicle stability control (VSC)
- dynamic stability control (DSC)
- vehicle stability assist (VSA)
- roll stability control (RSC)
- roll control system (RCS)
- electronic braking system (EBS)
- trailer electronic braking system (TEBS).

Advanced braking systems and their components may be easily damaged by common modification, maintenance and servicing techniques, such as the use of rattle guns within one metre of the sensors. When undertaking any work on a vehicle fitted with an advanced braking system, ensure all modifiers are familiar with these systems and the precautions that must be taken.

Ensure that before undertaking any modification on a vehicle that is fitted with an advanced braking system, the modifier and approved vehicle examiner (AVE) consult with the vehicle manufacturer to determine the impact on the system.

Modification Code A1 — Engine substitution

1. Scope

Modifications covered under this code:

Covered

- fitting of a replacement engine of similar mass and power output to that offered by the first manufacturer
- fitting of a replacement engine that meets later ADRs than those applicable at the time the vehicle was manufactured
- re-rating existing engines
- conversion from petrol engine to diesel and vice versa.

Not covered

- fitting of a replacement engine that does not comply with applicable ADRs, unless being fitted to a vehicle which pre-dates the ADRs
- fitting of a 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
- fitting of replacement engine that necessitates substantial modification to a vehicle's chassis, unless modifications complying with VSB6 Section H — Chassis are carried out at the same time
- installation or conversion of gaseous or other alternative fuel systems for use by the vehicle engine — refer to state or territory energy regulators.

2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the modifications in this code and require certification, testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related ADRs.

This…	Must comply with…
Engine mountings	Good engineering practice
Radiator mounting	Good engineering practice
Air induction / air cleaner	VSB6 Modification Code A2
Exhaust	VSB6 Modification Code A4
Noise	ADR 28, 28A, 28/.. ADR 83/..
Brake system — compressor recharge	ADR 35, 35A, 35/.. sections relating to *Special Provisions for Systems Using 'Stored Energy' (except 'Spring Brake Systems')*
Brake system — vacuum recharge	ADR 35, 35A, 35/.. sections relating to *Special Provisions for Systems Using 'Stored Energy' (except 'Spring Brake Systems')*
Cabin modifications	VSB6 Modification Code K3
Chassis modifications	VSB6 Modification Code H4
Steering	VSB6 Modification Code E2
Emissions — diesel	ADR 30, 30/.., ADR 70/.., ADR 80/..
Emissions — petrol	ADR 36, 36A, 36/.. ADR 80/..

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If yes, the modification will need to be done in accordance with manufacturer specifications. • If no, the modification will need to be done in accordance with this modification code.
2.	Modifier	Consult with an accredited A1 AVE for guidance on how to perform the modification.
3.	Modifier	Perform modification in accordance with AVE advice and this code.
4.	Modifier	Organise approval inspection by an accredited A1 AVE.
5.	A1 AVE	Perform inspection, complete A1 checklist and determine if compliance has been achieved. • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	A1 AVE	Issue modification certificate, affix modification plate, and submit paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

4. Compliance requirements

Required:

- Comply with all ADRs applicable to the vehicle at the time of manufacture or later.
- Ensure that a diesel engine fitted with a manufacturer's plate stating compliance with ADR 30/.. continues to meet ADR requirements. Engines requiring compliance with ADR 30/.. that have not been fitted with a manufacturer's plate stating compliance to ADR 30/.. require testing to demonstrate compliance before a plate can be fitted.
- If a replacement engine is certified to ADR 70/.. or 80/.., or sourced from an ADR 70/.. or 80/.., compliant vehicle, retain and maintain all emissions equipment and electronic controls applicable to that engine as well as any data record keeping capabilities fitted to the engine.
- Ensure that a replacement engine that complies with an ADR other than 30/.., 70/.. or 80/.. meets or exceeds the ADR requirements applicable at the vehicle's manufacture date or later.
- Ensure that systems required to meet ADR emission levels, such as selective catalytic reduction (SCR), exhaust gas recirculation (EGR) or diesel particulate filter (DPF), are installed in accordance with the engine manufacturer's guidelines.
- Ensure the air induction and exhaust system meets the manufacturer's design criteria for the new engine and meets or exceeds the requirements of the ADRs applying to both the engine and the vehicle at the time of original manufacture.
- When a vehicle that pre-dates the ADRs is fitted with an engine manufactured to meet an emission related ADR, retain and operate all the emission control devices fitted to the engine after installation, even though the original engine and

emissions design, and ADR approval may be related to another vehicle category.

- Certify that a vehicle with a modified or replaced engine complies with noise emissions requirements (ADR 28/.. or ADR 83/..). If a manufacturer's optional engine is fitted together with the engine's original air induction and exhaust systems then this demonstration of compliance with noise emissions requirements is not necessary.
- Obtain from the engine manufacturer the maximum back pressure levels allowed for the diesel engine to comply with ADR 30, 30/.. or 80/.., and adhere to these.

Recommended:

- Measure the exhaust back pressure with the engine operating under rated load conditions.
  - On a non-turbocharged engine, the back pressure should be measured as close as possible to the exhaust manifold and at least 300 mm downstream from a bend.
  - On a turbocharged engine, the back pressure should be measured within 150 mm of the turbo outlet and in line with the neutral axis of the upstream bend.

5. Design requirements

Engine types available include:

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

An engine should be selected according to service factors, such as:

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

Selection of an alternative engine for a heavy vehicle usually involves consideration of:

Engine type	to ensure the engine is appropriate for the vehicle and intended service conditions.
Engine output	to provide the performance required with acceptable durability.
Engine dimensions	to ensure suitability of the replacement engine dimensions for installation in the vehicle.
Engine compliance	to comply with emission related ADRs.

Engine type

To achieve safe operation and expected in-service engine performance, 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.

Duty cycle and tractive effort

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

The tractive effort required at a range of vehicle speeds can be determined by knowing:

- GVM and gross combination mass (GCM) of the vehicle
- gradeability required
- startability required
- maximum and cruising speeds required.

Replacement engines

If possible, choose an optional engine available from the manufacturer for that model vehicle as the replacement engine and install it as it would be installed by the vehicle manufacturer.

If the manufacturer's installation instructions are not available or not practicable for the installation, the following applies:

Required:

- Ensure vehicle components such as brakes, front axles and suspension have a suitable capacity or, when the replacement engine is heavier than the optional engines specified by the vehicle manufacturer, are upgraded as required and in accordance with VSB6.
- Ensure that the weight of the replacement engine does not cause the masses on the vehicle (such as the centre of gravity) to change so that any component (such as brakes, axle capacity or suspension) exceeds the lesser of:
  - jurisdictional legal load limits (unless specifically exempted by the relevant heavy vehicle regulator); or
  - the manufacturer's prescribed component limits.

  If necessary, you may need to upgrade the affected components in accordance with VSB6 to meet the new masses.
- Ensure the power and torque of the replacement engine does not exceed the capacity of the vehicle driveline.
- For a diesel engine, install an engine stop control as per ADR 42/.. to prevent the engine being started accidently.
- Ensure the replacement engine permits the vehicle, when laden to its rated GCM, to exceed whichever provides the lesser gradeability and startability requirements of either the manufacturer or VSB6 modification codes S3, S8 or S9.
- Ensure all components used are within the manufacturer's ratings.
- Ensure the engine air induction and exhaust system meet the design criteria relevant to the engine being installed.
- Ensure the replacement engine air compressor or brake system vacuum pump:
  - is replaced in accordance with VSB6 Section G — Brakes
  - meets the performance requirements of ADR 35/.., in particular the Special Provisions for Systems Using 'Stored Energy' (except 'Spring Brake Systems').

Recommended:

- If the replacement engine is not an optional engine available from the manufacturer for that model, select a replacement engine of similar mass, power and torque output to that of an engine fitted by the original vehicle manufacturer as standard or optional equipment.

Engine output

Once the tractive effort requirement for a vehicle is known you can compare its output curves against various engine speeds.

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.

Engine dimensions

Required:

- Using the engine manufacturer's published specifications, check the selected engine against the vehicle to ensure that:
  - it fits into the available space without major chassis, cab or other modifications, unless related modifications are performed in accordance with VSB6 Section H — Chassis
  - the engine mass and location of the centre of gravity does not result in an unacceptable front axle load.

Recommended:

- Using the engine manufacturer's published specifications, check the selected engine against the vehicle to verify that:
  - the location of engine ancillaries, such as cooling system intake and exhaust, to ensure they are suitable for the vehicle's operational environment.
- Consider that changing an engine beyond the limits of the vehicle manufacturer's recommendations may result in problems.
- Seek direction from the vehicle, engine or system manufacturers or suppliers before selecting and configuring the engine.

Engine mounting

Factors to be considered when designing engine mounts are:

Weight support	design of frame mounting brackets or cross-members
Torsional restraint	extra support structure may be required
Longitudinal restraint	extra support structure may be required
Vibration isolation	resilient mountings should be tuned to provide acceptable isolation and avoid resonant vibrations
Chassis deflection	reinforcement of chassis members at mounting points
Driveline angularity	the engine location must ensure that universal joint angles are within the driveline manufacturer recommendations (See VSB6 Section C — Tail shafts).

Required:

- Ensure replacement engine mountings are suitable for automotive use and designed to withstand torsional loads transmitted by the engine and can restrict excess engine movement to prevent damage to components such as the cooling fan and radiator.
- If fitting the replacement engine requires chassis modifications or chassis cut-outs that exceed those provided by the manufacturer, ensure these modifications are in accordance with VSB6 Section H — Chassis.
- Ensure all removed cross-members are replaced with original manufacturer-supplied like-for-like cross-members or cross-members compliant with VSB6 Section H — Chassis.
- Ensure the engine has adequate clearance including between the engine and chassis/cab components to accommodate engine movement.

Recommended:

- Maintain a clearance of at least 10 mm between engine and chassis/cab components to accommodate engine movement.
- Install the replacement engine in a position and angle that ensures the driveline continues to comply with VSB6 Section C — Tail shafts.
- Retain or augment all original heat and sound insulation material to account for the replacement, substituted, additional or altered engine.

Cooling system requirements

The cooling system should meet the requirements laid down by the engine manufacturer. Development of a balanced, trouble-free cooling system appropriate for the engine/vehicle combination involves consideration of many factors and selection of the main components (radiator, fan, and shroud etc.) should be done in conjunction with specialist suppliers.

Recommended:

- Ensure the system provides sufficient head of water on the coolant pump inlet to prevent cavitation by arranging for the coolant level in the reservoir to be higher than the highest point in the engine galleries, including the pump.
- Avoid causes of high restriction on the pump suction inlet and make engine inlet/outlet diameters greater than the radiator inlet/outlet diameter.
- Adhere to the specific coolant filling requirements of the engine manufacturer.
- Allow for engine/vehicle movement and ease of installation for piping between the radiator and the engine.
- Support piping, if necessary, to avoid excessive loads being placed on hose and piping connections and to minimise vibration.
- Avoid kinking of piping.

Use a larger cooling fan, turning at the slowest speed to achieve the required air flow: fans absorb a significant amount of engine power and can create high levels of noise. Consult a specialist fan supplier for further advice.

Fuel system requirements

Required:

- Adhere to the manufacturer's specific requirements for the engine's fuel system, including filtration, cooling and water removal.
- Adhere to the fuel pump requirements as specified by the engine manufacturer for all ADR certified engines.
- Ensure the fuel system meets the requirements of the engine manufacturer, including fuel filtration and suction lift.
- Ensure the fuel supply line to the engine is of the size and quality required for the engine installation and fuel type.
- Ensure that liquefied petroleum gas (LPG) fuelled vehicles comply with the requirements of ADR 44/.. and AS/NZS 1425 LP Gas fuel systems for vehicle engines and test the completed vehicle to the requirements of DT80, NHVR simplified emissions test procedure or ADR 80/.. Emission Rates as required by the relevant heavy vehicle standards regulation.
- Ensure that natural gas (NG) fuelled vehicles comply with the requirements of AS/NZS 2739 Natural Gas (NG) fuel systems for vehicle engines and test the completed vehicle to the requirements of DT80, NHVR simplified emissions test procedure or ADR 80/.. Emission Rates as required by the relevant heavy vehicle standards regulation.
- If diesel engines are converted to operate on an alternative fuel other than LPG or NG by themselves which are covered by AS/NZS 1425 LP Gas fuel systems for vehicle engines and AS/NZS 2739 Natural gas (NG) fuel systems for vehicle engines, in a single fuel, multi-simultaneous fuels or dual fuel mode, test the completed vehicle to the requirements of DT80, NHVR simplified emissions test procedure or ADR 80/.. Emission Rates as required by the relevant heavy vehicle standards regulation.

↘ The installation, modification or removal of gas fuel systems fitted to a vehicle is regulated by energy regulators in each state and territory.

↘ Before installing, modifying or removing a gas fuel system, please consult with a licenced gas fitter/installer in the state or territory where the vehicle is being modified.

- If conversions are performed on multiple vehicles, hold a satisfactory DT80, NHVR simplified emissions test procedure or ADR 80/.. (as applicable) test result for one vehicle where the following applies:

- all vehicles are fitted with the same make and model engine
- conversion equipment is identical on all engines
- air inlet and filtration is identical on all engines
- DT80, NHVR simplified emissions test procedure ADR 80/.. (as applicable) test results document all applicable information from the test vehicle.

- Ensure fuel lines are secure and clear of the exhaust system and any turbochargers at all times.
- Ensure adequate protection from excessive heat for all hoses, electrical harnesses, rubber or plastic components.

A1 Checklist – Engine substitution (example)

A1 Checklist — Engine substitution

This checklist is for use by approved vehicle examiners (AVEs) to assess modifications relating to engine substitution.

Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	**Vehicle chassis no. (if applicable):**	**Vehicle modifier (company name):**

Engine details

Engine no.		Engine make		Engine model		Capacity	

Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Is the advanced braking system (where fitted) un-effected or re-certified after the vehicle modification?	☐	☐	☐

Modification details

Modification criteria	Check Yes, No as applicable:	Yes	No
1	Has the modification been performed in accordance with the manufacturer's guidelines?	☐	☐

Installation details

Frame	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Do chassis rail cut-outs satisfy manufacturer recommendations or VSB6 Section H – Chassis?	☐	☐	☐
2	Have all cross-members that have been removed been replaced with an original manufacturer-supplied like-for-like cross member or a cross member as per VSB6 Section H – Chassis?	☐	☐	☐
Engine	**Check Yes, No, N/A as applicable:**	**Yes**	**No**	**N/A**
1	What is the maximum acceptable inlet depression?			
2	What inlet depression was measured?			
3	Is the measured depression within the acceptable inlet depression?	☐	☐	☐
4	What is the maximum acceptable exhaust back pressure?			
5	What exhaust back pressure was measured?			
6	Is the measured pressure within the acceptable exhaust back pressure?	☐	☐	☐
7	Does the engine air induction system, inlet depression and exhaust back pressure within acceptable limits to ensure compliance with Australian Design Rule (ADR) 30, ADR 30/.. and/or ADR 80/.. as applicable?	☐	☐	
8	Does the air compressor or the vacuum pump for brakes meet the required performance for ADR 35/.. (specifically sections relating to 'Special Provisions for Systems Using 'Stored Energy' (except Spring Brake Systems)'?	☐	☐	
9	Has the replacement air compressor or vacuum pump for the brakes been replaced in accordance with VSB6 Section G — Brakes?	☐	☐	☐
10	Has adequate protection been provided for all hoses, wiring harnesses, rubber and plastic components?	☐	☐	
11	Are fuel lines secure and clear of the exhaust system and any turbocharger?	☐	☐	
12	Does the engine installation comply with all applicable ADRs at the time of manufacture or later?	☐	☐	
13	Is a diesel engine stop control fitted which will prevent accidental or inadvertent starting? (diesel engines only)	☐	☐	☐
14	Are engine mountings suitable for automotive use and designed to withstand vertical and torsional loads transmitted by replacement engine?	☐	☐	
15	Does the engine have adequate clearance including between axle, chassis and cab?	☐	☐	
16	Does the engine have performance requirements to permit the vehicle to match or exceed the manufacturer's grade-ability specification or the grade-ability requirements in VSB6 modification codes S3, S8 or S9?	☐	☐	
17	Does the fuel system meet the engine manufacturer's requirements for fuel filtration, cooling and suction lift?	☐	☐	

Vehicle chassis no./VIN:	Date:	Signed:

A1 Checklist — Engine substitution

This checklist is for use by approved vehicle examiners (AVEs) to assess modifications relating to engine substitution.

Compliance

Modification	Check Yes, No as applicable:	Yes	No
1	Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code A1?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
3	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.

Comments:			
Examined by:	Company (if applicable):		AVE no.:
Signed:	Modification certificate no.:	Modification plate no.:	Date:

Vehicle chassis no./VIN:	Date:	Signed:

A1 Modification report – Engine installation (example)

A1 Modification report – Engine installation

This report is for use by engine installers and approved vehicle examiners (AVEs) when performing or assessing engine installations.

Vehicle and modifier details

		Report no.:
Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	Vehicle chassis no. (if applicable):	Vehicle modifier (company name):

Enter details

Engine	Original	New
Make		
Model		
Number		
Capacity		
Power KW @ RPM		
Torque NM @ RPM		
ADR 30 compliant		
ADR 36 compliant		
ADR 80 compliant + version		
Driveline	**Original**	**New**
Transmission input torque		
Driveline angularity degrees		
Driveline shaft OD		
Universal joint yoke size		
Rear axle load capacity		
Operating characteristics	**Original**	**New**
Transmission ratio 1st gear		
Transmission ratio top gear		
Rear axle ratio(s)		
Tyre size		
Maximum road speed		
Air compressor capacity		
Vehicle	**Original**	**New**
Front axle load		
GVM and GCM		
ADR 17 compliant if applicable		
ADR 28 compliant if applicable		
ADR 30 compliant if applicable		
ADR 36 compliant if applicable		
ADR 80 compliant if applicable		
Engine clearance to other components		
Engine heat and vibration insulation		

Authorisation

Comments:			
Examined by:	Company (if applicable):		AVE no.:
Signed:	Modification certificate no.:	Modification plate no.:	Date:

Vehicle chassis no./VIN:	Date:	Signed:

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Modification Code A2 — Air cleaner substitution or additional fitting

1. Scope

Modifications covered under this code:

Covered

- fitting of an additional air cleaner
- fitting of an alternative air cleaner
- repositioning of an air cleaner
- repositioning of induction pipes
- removal of an air cleaner (on multi-air cleaner systems only).

Not covered

- elimination of an air cleaner system
- fitting of an air cleaner that results in the vehicle not complying with the ADRs.

➘ An appropriately sized air cleaner must always be incorporated into a vehicle induction system if required by the manufacturer.

2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the modifications in this code and require certification, testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related ADRs.

This…	Must comply with…
Fitting/removal of air cleaner	ADR 28, 28A, 28/.. ADR 30, 30A, 30/.. ADR 36, 36A, 36/.. ADR 44/.. ADR 70/.. ADR 80/.. ADR 83/.. AS 2739 Good engineering practice

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If **yes**, the modification will need to be done in accordance with manufacturer specifications. • If **no**, the modification will need to be done in accordance with this modification code.
2.	Modifier	Consult with an accredited A2 AVE for guidance on how to perform the modification.
3.	Modifier	Perform modification in accordance with AVE advice and this code.
4.	Modifier	Organise approval inspection by an accredited A2 AVE.
5.	A2 AVE	Perform inspection, complete A2 checklist and determine if compliance has been achieved. • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	A2 AVE	Issue modification certificate, affix modification plate, and submit paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

4. Compliance requirements

Required:

- Comply with all ADRs applicable to the vehicle at the time of manufacture.
- Ensure the air induction system meets the manufacturer's design criteria for the engine and meets or exceeds the requirements of the ADRs applying to both the engine and the vehicle installation at the time of original manufacture.
- For diesel engines required to comply with ADR 30, 30/.., 70/.. or 80/.., design the air intake system so that the inlet depression conforms to the requirement in ADR 30, 30/.., 70/.. or 80/.. .
- Ensure the engine does not exceed the maximum allowable inlet depression under ADR 30, 30/.., 70/.. or 80/.. as specified by the engine manufacturer.
- Ensure engine and air cleaner manufacturers' requirements are met.

5. Design requirements

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

Recommended:

- Consult engine and air cleaner suppliers during design of the system.
- Consider operating conditions and service intervals when determining the air cleaner size for any particular installation.
- Multiple filters and two-stage air cleaner systems may be necessary in high dust operating environments or where extended service intervals are desired.
- Fit an air cleaner service indicator.
- Locate air inlets to maximise cool air charge and to minimise the ingestion of water, e.g. during rain, washing the vehicle.
- Do not locate air inlets near exhaust manifolds or pipes.

6. Installation requirements

Recommended:

- Incorporate flexible fittings in the system with adequate support to prevent failure due to misalignment, engine movement and vibration.
- Ensure all joints are airtight.
- Retain or augment all original heat and sound insulation material to account for the replacement, substituted, additional or altered air cleaner.
- Ensure system is designed so as to minimise the risk of the ingress of water.

A2 Checklist – Air cleaner substitution or additional fitting (example)

A2 Checklist — Air cleaner substitution or additional fitting

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to air cleaner substitution or additional fitting.

Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	**Vehicle chassis no. (if applicable):**	**Vehicle modifier (company name):**

Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Is the advanced braking system (where fitted) un-effected or re-certified after the vehicle modification?	☐	☐	☐

Modification details

Modification criteria	Check Yes, No as applicable:	Yes	No
1	Has the modification been performed in accordance with the manufacturer's guidelines?	☐	☐

Installation details

Installation	Check Yes, No as applicable:	Yes	No
1	What is the maximum acceptable inlet depression?		
2	What inlet depression was measured?		
3	Is the measured depression within the acceptable inlet depression?	☐	☐
4	Is the inlet depression within the acceptable limits to ensure compliance with Australian Design Rule (ADR) 30, ADR 30/.. and/or ADR 80/.. as applicable?	☐	☐
5	Is the engine air induction system matched to the requirements of the engine in efficiency and performance to maintain compliance with the applicable ADR?	☐	☐
6	Is the additional or alternative air cleaner assembly incorporated into the engine induction system of an appropriate size?	☐	☐

Compliance

Modification	Check Yes, No as applicable:	Yes	No
1	Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code A2?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
3	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.

Comments:			
Examined by:	**Company (if applicable):**		**AVE no.:**
Signed:	**Modification certificate no.:**	**Modification plate no.:**	**Date:**

Vehicle chassis no./VIN:	Date:	Signed:

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Modification Code A3 — Turbocharger installation

1. Scope

Modifications covered under this code:

Covered

- fitting of a turbocharger to a diesel engine
- fitting of an intercooler (after-cooler) to a turbocharged diesel engine.

Not covered

- fitting of a turbocharger to an engine that contravenes any ADRs
- fitting of a turbocharger to an engine that results in the power/torque output of the engine not being compatible with the original vehicle componentry.

2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the modifications in this code and require certification, testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related ADRs.

This…	Must comply with…
Substitute manifolds	Good engineering practice
Substitute air cleaner	VSB6 Modification Code A2
Fit oil lines	Good engineering practice
Fit turbocharger	Good engineering practice
Adjust fuel pump	ADR 30, 30A, 30/.. ADR 36, 36A, 36/.. ADR 70/.. ADR 80/.. Good engineering practice
Replace injectors	ADR 30/.. ADR 70/.. ADR 80/.. Good engineering practice
Substitute exhaust	VSB6 Modification Code A4
Noise	ADR 28/.. ADR 83/..

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If **yes**, the modification will need to be done in accordance with manufacturer specifications. • If **no**, the modification will need to be done in accordance with this modification code.
2.	Modifier	Consult with an accredited A3 AVE for guidance on how to perform the modification.
3.	Modifier	Perform modification in accordance with AVE advice and this code.
4.	Modifier	Organise approval inspection by an accredited A3 AVE.
5.	A3 AVE	Perform inspection, complete A3 checklist and determine if compliance has been achieved. • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	A3 AVE	Issue modification certificate, affix modification plate, and submit paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

4. Compliance requirements

Required:

- Comply with all ADRs applicable to the vehicle at the time of manufacture.
- Ensure the air induction and exhaust system meets the manufacturer's design criteria for the engine and meets or exceeds the requirements of the ADRs applying to the vehicle at the date it was manufactured. Where the air induction and exhaust system is sourced from a vehicle that complies with a more recent ADR than the vehicle, all emission control systems and equipment from the replacement system must be retained.
- Ensure the vehicle meets ADR 28/.. or ADR 83/.. requirements and perform testing if necessary to confirm ongoing compliance.
- For vehicles certified to ADR 70/.. or ADR 80/.., ensure the vehicle continues to comply with emission requirements either by comparison to an identical vehicle or by physical testing.
- Ensure intercooling (after-cooling) does not adversely affect engine durability or compliance with emission requirements.

5. Installation requirements

↘ The installation of a turbocharger to a diesel engine can increase the power output of an engine, but if not performed correctly the vehicle may fail to comply with emissions requirements and its lifespan may be reduced significantly.

When installing a turbocharger to a diesel engine:

Required:

- Ensure good engineering practice is adhered to at all times.
- Ensure all fuel lines are secure and clear of the exhaust and turbocharger systems at all times and provide adequate protection from excessive heat for all hoses, electrical harnesses, rubber or plastic components.
- Ensure the new engine meets inlet depression and exhaust back pressure requirements of that engine's applicable ADR approval. Back pressure should be measured within 150 mm of the turbo outlet and in line with the neutral axis of the upstream bend.
- Ensure the engine air induction system maintains compliance with ADR 30/.., 70/.. and 80/.., as applicable, by matching the efficiency and performance requirements of the new engine.
- Ensure turbocharger housing is not subject to excessive weight from downstream components of the exhaust system.
- Follow the engine manufacturer's recommendations for exhaust system design.

- Ensure engine output remains compatible with the vehicle drivetrain.
- Adhere to VSB6 Modification Code A4 if an exhaust system or manifold is substituted to allow for fitting of the turbocharger.
- Adhere to VSB6 Modification Code A2 if additional or substitute air cleaners are fitted to cater for additional airflow from the turbocharger.
- If replacement injectors have been fitted and the fuel pump is adjusted to cater for additional airflow, ensure that the vehicle complies with ADR 30/.., 70/.. and 80/.. as applicable.

Recommended:

- When choosing the intercooler to be installed, give attention to the added restriction of air flow through the radiator and the potential for reduced engine cooling system capability.
- Consider the effect of intercooler expansion on mountings.
- Consider the need to fit additional or re-route existing oil lines to cool the turbocharger.
- Secure and clear all oil lines of the exhaust and turbocharger systems.
- Consider the need for appropriate heat shields and exhaust bracing.
- Retain or augment all original heat and sound insulation material to account for the replacement, substituted, additional or altered turbocharger.

Cooling system requirements

The cooling system should meet the requirements laid down by the engine manufacturer. Development of a balanced, trouble-free cooling system appropriate for the engine/vehicle combination involves consideration of many factors and selection of the main components (radiator, fan, and shroud etc.) should be done in conjunction with specialist suppliers.

Recommended:

- Ensure the system provides sufficient head of water on the coolant pump inlet to prevent cavitation by arranging for the coolant level in the reservoir to be higher than the highest point in the engine galleries, including the pump.
- Avoid causes of high restriction on the pump suction inlet and make engine inlet/outlet diameters greater than the radiator inlet/outlet diameter.
- Adhere to the specific coolant filling requirements of the engine manufacturer.
- Allow for engine/vehicle movement and ease of installation for piping between the radiator and the engine.
- Support piping, if necessary, to avoid excessive loads being placed on hose and piping connections and to minimise vibration.
- Avoid kinking of piping.
- Use a larger cooling fan, turning at the slowest speed to achieve the required air flow: fans absorb a significant amount of engine power and can create high levels of noise. Consult a specialist fan supplier for further advice.

A3 Checklist – Turbo charger installation (example)

A3 Checklist — Turbo charger installation

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to turbo charger installations.

Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	**Vehicle chassis no. (if applicable):**	**Vehicle modifier (company name):**

Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Is the advanced braking system (where fitted) un-effected or re-certified after the vehicle modification?	☐	☐	☐

Modification details

Modification criteria	Check Yes, No as applicable:	Yes	No
1	Has the modification been performed in accordance with the manufacturer's guidelines?	☐	☐

Installation details

Installation	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	What is the maximum acceptable inlet depression?			
2	What inlet depression was measured?			
3	Is the measured depression within the acceptable inlet depression?	☐	☐	
4	What is the maximum acceptable exhaust back pressure?			
5	What exhaust back pressure was measured?			
6	Is the measured pressure within the acceptable exhaust back pressure?	☐	☐	
7	Does the engine air induction system, inlet depression and exhaust back pressure within acceptable limits to ensure compliance with Australian Design Rule (ADR) 30, ADR 30/.. and/or ADR 80/.. as applicable?	☐	☐	
8	Has adequate protection been provided for all hoses, wiring harnesses, rubber and plastic components?	☐	☐	
9	Are fuel lines secure and clear of the exhaust and turbocharger systems?	☐	☐	
10	Has the engine output, after installation of the turbo charger, remained compatible with the vehicle drive train?	☐	☐	
11	Where an exhaust system or manifold has been substituted, has it been substituted in accordance with VSB6 Modification Code A4?	☐	☐	☐
12	Where additional or substitute air cleaners are fitted, have they been fitted in accordance with VSB6 Modification Code A2?	☐	☐	☐

Compliance

Modification	Check Yes, No as applicable:	Yes	No
1	Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code A3?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
3	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.

Comments:			
Examined by:	**Company (if applicable):**		**AVE no.:**
Signed:	**Modification certificate no.:**	**Modification plate no.:**	**Date:**

Vehicle chassis no./VIN:	Date:	Signed:

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Modification Code A4 — Exhaust system alteration

1. Scope

Modifications covered under this code:

Covered

- re-routing, lengthening or shortening of exhaust system
- fitting of alternative mufflers
- fitting of alternative exhaust systems
- relocation of exhaust outlets.

Not covered

- removal of mufflers
- fitting of exhaust components which will contravene any ADR.

2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the vehicle modifications and require certification, testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related ADRs.

This…	Must comply with…
Changes to the exhaust system	ADR 28, 28A, 28/.. ADR 30, 30A, 30/.. ADR 36, 36A, 36/.. ADR 70/.. ADR 80/.. ADR 83/..

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If **yes**, the modification will need to be done in accordance with manufacturer specifications. • If **no**, the modification will need to be done in accordance with this modification code.
2.	Modifier	Consult with an accredited A4 AVE for guidance on how to perform the modification.
3.	Modifier	Perform modification in accordance with AVE advice and this code.
4.	Modifier	Organise approval inspection by an accredited A4 AVE.
5.	A4 AVE	Perform inspection, complete A4 checklist and determine if compliance has been achieved. • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	A4 AVE	Issue modification certificate, affix modification plate, and submit paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

4. Compliance requirements

Required:

- Comply with all ADRs applicable to the vehicle at the time of manufacture.
- Ensure the exhaust system meets the manufacturer's design criteria for the modified engine and meets or exceeds the requirements of the ADRs applying to the vehicle at the date it was manufactured. Where the exhaust system is sourced from a vehicle that complies with a more recent ADR than the vehicle, all emission control systems and equipment from the replacement system must be retained.
- Ensure that systems required to meet ADR emission levels, such as selective catalytic reduction (SCR), exhaust gas recirculation (EGR) or diesel particulate filter (DPF), are installed in accordance with the engine manufacturer's guidelines.

Recommended:

- Retain or augment all original heat and sound insulation material to account for the replacement, substituted, additional or altered exhaust system.

5. Installation requirements

The exhaust system must be designed to safely disperse exhaust gases into the atmosphere while not exceeding noise limits set by ADRs or the back pressure limit set by the engine manufacturer. It is strongly recommended that the exhaust system is developed in conjunction with both engine and exhaust system suppliers.

The following requirements apply when modifying exhaust systems:

Exhaust system design

Compliance of an exhaust system with ADR requirements can be impacted by exhaust routing, muffler, after-treatment, tailpipe length, diameter, and discharge orientation.

Where an exhaust design does not comply with the manufacturer's specification, testing is required to ensure continued ADR compliance.

Required:

- Obtain from the engine manufacturer the maximum back pressure levels allowed for the diesel engine to comply with ADR 30, 30/.. or 80/.., and adhere to these.
- Measure the exhaust back pressure in accordance with the manufacturer's requirements and with the engine operating under rated load conditions.
  - On a non-turbocharged engine, the back pressure should be measured as close as possible to the exhaust manifold and at least 300 mm downstream from a bend.
  - On a turbocharged engine, the back pressure should be measured within 150 mm of the turbo outlet and in line with the neutral axis of the upstream bend.
- Ensure location and direction of the exhaust outlet conforms to the requirements of ADR 42/.. .
- Ensure that the exhaust components remain clear of any fuel lines and fuel system components so as not to pose a fire hazard.
- When positioning the exhaust, ensure it is not placed in a location where overflow from a fuel filling operation may allow spilling onto any part of the exhaust.

- Ensure the exhaust location of special vehicles, such as road tank vehicles and omnibuses, conforms to the requirements of additional ADRs and relevant Australian Standards.
- Ensure fuel lines are secure and clear of the exhaust system at all times and provide adequate protection from excessive heat for all hoses, electrical harnesses, rubber or plastic components.

Recommended:

- Consider an allowance for thermal expansion throughout the system.
- Only use sharp radius bends and reducers in the pipe run as a last resort to assist to minimise back pressure.
- Do not place the exhaust pipe under fuel tanks or fillers.
- Direct the exhaust outlet away from the driver/operator, engine air inlet and cooling systems.
- Prevent water from entering the exhaust outlet.
- Do not subject housings to excessive weight from downstream components of the exhaust system. Follow the engine manufacturer's recommendations.

A4 Checklist – Exhaust system alteration (example)

A4 Checklist — Exhaust system alteration

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to exhaust system alterations.

Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	**Vehicle chassis no. (if applicable):**	**Vehicle modifier (company name):**

Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Is the advanced braking system (where fitted) un-effected or re-certified after the vehicle modification?	☐	☐	☐

Modification details

Modification criteria	Check Yes, No as applicable:	Yes	No
1	Has the modification been performed in accordance with the manufacturer's guidelines?	☐	☐

Installation details

Installation	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	What is the maximum acceptable exhaust back pressure?			
2	What exhaust back pressure was measured?			
3	Is the measured pressure within the acceptable exhaust back pressure?	☐	☐	
4	Is the exhaust back pressure within acceptable limits to ensure compliance with Australian Design Rule (ADR) 30, ADR 30/.. and/or ADR 80/.. as applicable?	☐	☐	☐
5	Does the exhaust system alteration meet the manufacturer's design criteria for the engine and meet or exceed the requirements of the ADRs applying to both the engine and the vehicle installation at the time of original manufacture?	☐	☐	
6	Is the location and direction of the exhaust outlet/s in accordance with ADR 42/.. requirements?	☐	☐	
7	Has adequate protection been provided for all hoses, electrical harnesses, rubber, plastic components?	☐	☐	
8	Are fuel lines secure and clear of the exhaust system?	☐	☐	

Compliance

Modification	Check Yes, No as applicable:	Yes	No
1	Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code A4?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
3	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.

Comments:			
Examined by:	**Company (if applicable):**		**AVE no.:**
Signed:	**Modification certificate no.:**	**Modification plate no.:**	**Date:**

Vehicle chassis no./VIN:	Date:	Signed:

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Modification Code A5 — Road speed limiter installation

1. Scope

Modifications covered under this code:

Covered

- the installation of an approved road speed governor system*
- calibration, certification and sealing of road speed governor systems

Not covered

- fitting of non-approved road speed governors
- fitting of systems that are not compatible with the existing vehicle components.

➘ *An approved road speed governor must comply with the requirements of ADR 65/.. or BS AU 217: Part 1 1987 *Maximum Road Speed Limiters for Motor Vehicles*.

➘ AVEs must determine from the supplier of the part that it meets one of these standards and ensure that it is installed in accordance with manufacturer recommendations.

2. Related standards

Modified vehicles must comply with all ADRs, Australian Standards, acts and regulations. Below are some but not all of the areas that may be affected by the modifications in this code and require certification testing or evidence to demonstrate compliance.

The certifier must ensure that the modified vehicle continues to comply with all related ADRs.

This…	Must comply with…
Performance of road speed limiter	ADR 65/..

3. Certification procedure

The certification procedure for this modification code is as follows:

1.	Modifier	Determine if the modification is within manufacturer specifications. • If **yes**, the modification will need to be done in accordance with manufacturer specifications. • If **no**, the modification will need to be done in accordance with this modification code.
2.	Modifier	Consult with an accredited A5 AVE for guidance on how to perform the modification.
3.	Modifier	Perform modification in accordance with AVE advice and this code.
4.	Modifier	Organise approval inspection by an accredited A5 AVE.
5.	A5 AVE	Perform inspection, complete A5 checklist and determine if compliance has been achieved. • If **yes**, proceed to step 6. • If **no**, do not proceed, advise modifier rework is required to ensure compliance. Return to step 2.
6.	A5 AVE	Issues modification certificate, affixes modification plate listing the rated speed, and submits paperwork as required by the relevant AVE registration scheme.

AVEs must be satisfied that vehicle modification requirements are being met. It is advised that before modifications are carried out they are discussed with the certifying AVE.

4. Compliance requirements

Required:

- Comply with all ADRs applicable to the vehicle at the time of manufacture.

5. Installation requirements

An approved road speed governor system may only be installed under this code to the following vehicles:

- ME and NC category vehicles with dates of manufacture as defined in ADR 65/.. Maximum Road Speed Limiting for Heavy Goods Vehicles and Heavy Omnibuses
- all other vehicles covered by ADR 65/..
- in-service vehicles as specified by a relevant heavy vehicle regulator.

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 revolutions per minute (RPM), it is unable to exceed 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.

Maximum road speed capability

Required:

- Ensure the maximum road speed capability:
  - for a hauling vehicle designed for use in road train combination is no greater than that determined by the appropriate state or territory authority
  - for other heavy goods vehicles and heavy omnibuses is no greater than that specified in ADR 65/..
  - is not able to be increased or removed temporarily.
- Ensure that if the road speed governor is not installed as part of an integrated system:
  - it is operated independently of the vehicle's braking system; and
  - all components needed to fulfil its function are energised whenever the vehicle is in operation.

Heat and sound insulation

Recommended:

- Retain or augment all original heat and sound insulation material to account for the replacement or substituted road speed limiter.

6. Testing requirements

Required:

- Ensure vehicles covered by ADR 65/.. and subsequently modified, or vehicles not subject to ADR 65/.. and subsequently fitted with a road speed limiter, are verified in accordance with either:
  - ADR 65/.. procedures; or
  - the Abridged Test of Road Speed Limitation procedure; or
  - written evidence from the vehicle manufacturer (not a dealer).

Abridged Test of Road Speed Limitation

Test conditions

Required:

- Ensure the settings of the test vehicle, including fuel feed, wheels, tyres and transmission, conform to manufacturer specifications.
- Bed the tyres and ensure pressures are as specified by the manufacturer.
- Ensure the vehicle is unladen.

Verification of rated engine speed

The rated engine speed is the speed above which the engine governing system begins to reduce power substantially. It is initially set by the engine manufacturer; however, this may have altered in service and therefore must be verified.

Required:

Verify the rated engine speed using a chassis dynamometer or the following physical test:

1. Perform a calibration check by verifying the accuracy of the vehicle's tachometer against a calibrated hand-held tachometer.
2. Determine the maximum engine speed by driving the vehicle in gear. Correct the vehicle tachometer reading as necessary using the results from the calibration check to obtain the true rated engine speed.
3. In vehicles that determine maximum road speed capability by gearing, stamp the rated engine speed on the modification plate and indicate this on the modification certificate.

Speedometer accuracy

Required:

- Verify the accuracy of the vehicle's speedometer using a chassis dynamometer or by employing a qualified instrument servicing organisation.

Road test

Required:

- Test the vehicle in both directions over a substantially level section of road for a minimum distance of 1.6 km, with the accelerator fully applied for the entire distance of each test.
- If speed is limited by insufficient power, ensure the vehicle is travelling at 90 km/h at the start of the test and 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.
- Ensure the vehicle's true speed in any gear does not exceed 100 km/h on completion of either test in opposite directions.

Recommended:

- If speed is limited by gearing, consider having the vehicle travel at 90 km/h at the start of the test and 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.
- When an unloaded vehicle is being tested, hold the engine RPM to the rated engine speed (as advised in this section). When not operating under high load conditions, it is normal for the engine RPM to exceed its rated speed due to governor droop.
- For vehicles fitted with an approved road speed governor, consider a similar test. Note 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.

Chassis dynamometer test

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

Required:

- Ensure this test is adapted to suit state and territory specific speed limits for road trains and other multi-combinations.

Certification

Required:

- For mechanical governor systems, fit these parts with a tamper evident seal bearing the approved person's number as identification to indicate if the component has been tampered with:
  - governor road speed adjustment mechanism
  - two ends of link between the road speed limiter and the injection pump
  - two ends of link between the road speed limiter and the device providing the road speed signal.
- For mechanical road speed limiting equipment, use sealable casings to make all internal parts of the equipment resistant to tampering.
- For electronic road speed governors, seal the control unit and mark it with the approved person's number to prevent unauthorised entry into the box containing the electronic control circuitry.

A5 Checklist – Road speed limiter installation (example)

A5 Checklist — Road speed limiter installation

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to road speed limiter installations.

Vehicle and modifier details

Vehicle make:	Vehicle model:	Month and year of manufacture:
VIN (if applicable):	**Vehicle chassis no. (if applicable):**	**Vehicle modifier (company name):**

Speed limiting details

Vehicle details:		Method of speed limiting:		Road speed governors:		Applicable ☐
Rear axle ratio		Road speed governor	☐	Make		
Transmission ratio highest gear		Geared speed control	☐	Model		
Tyre size		Engine power	☐	Serial no.		

Advanced braking systems

Braking systems	Check Yes, No, N/A as applicable:	Yes	No	N/A
1	Is the advanced braking system (where fitted) un-effected or re-certified after the vehicle modification?	☐	☐	☐

Modification details

Modification criteria	Check Yes, No as applicable:	Yes	No
1	Has the modification been performed in accordance with the vehicle manufacturer's guidelines?	☐	☐

Installation details

Installation	Check Yes, No, N/A as applica	Yes	No	N/A
1	Has the supplier provided a certificate or other suitable evidence that the road speed governor complies with Australian Design Rule (ADR) 65/.. or BS AU 217:1987 requirements?	☐	☐	
2	Has the road speed governor been installed in accordance with the limiter manufacturer's requirements?	☐	☐	☐
3	Is the maximum road speed setting prevented from being temporarily increased or removed?	☐	☐	
4	If road speed governor is not integrated into a system (e.g. intelligent cruise control or driver assist and safety systems) is its operation completely independent of the vehicle's braking system?	☐	☐	☐
5	Are all components needed for full function of road speed governor energised when the vehicle is driven?	☐	☐	☐
6	Are lead seals fitted to the following parts to indicate attempts to tamper with road speed governor operation?			
	• governor road speed adjustment mechanism	☐	☐	☐
	• two ends of the link between the road speed limiter and the injection pump	☐	☐	☐
	• two ends of the link between the road speed limiter and the device providing the road speed signal	☐	☐	☐
	• all internal parts of the mechanical road speed limiting equipment	☐	☐	☐
	• control unit of the electronic road speed governor	☐	☐	☐

Vehicle chassis no./VIN:	Date:	Signed:

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A5 Checklist — Road speed limiter installation

This checklist is for use by approved vehicle examiners (AVEs) when assessing modifications relating to road speed limiter installations.

Testing details

Geared speed control				Applicable ☐
Rated engine speed (L)		Tyre size		
Rear axle ratio		Tyre revolutions per kilometre (M)		
Transmission ratio in highest gear		Calculated maximum road speed capability		
Overall gear reduction ratio (A)				

Road test					Applicable ☐
Has the accuracy of the speedometer been checked?	Yes	☐	No	☐	
Actual speedometer reading at set speed of vehicle			km/h		
Maximum true vehicle speed during test	Test 1	km/h	Test 2	km/h	
Were vehicle testing and results in accordance with ADR 65/.. (or Item 4 of this modification code)?	Yes	☐	No	☐	

Test using a dynamometer				Applicable ☐
Has the dynamometer been calibrated in the past six (6) months?	Yes	☐	No	☐
Date of calibration				
Was the dynamometer set up to simulate test conditions outlined in ADR 65/.. or Section A – Engines?	Yes	☐	No	☐
Maximum vehicle speed reading			km/h	

Compliance

Modification	Check Yes, No as applicable:	Yes	No
1	Does this modification meet all the requirements of the manufacturer's guidelines / Modification Code A5?	☐	☐
2	Is the quality of the work to an accepted industry standard?	☐	☐
3	Does the vehicle continue to comply with ADRs and heavy vehicle standards regulations affected by the modification?	☐	☐

Authorisation

Other than modification criteria, if the answer to any relevant question is NO the modification is not acceptable.			
Comments:			
Examined by:	Company (if applicable):		AVE no.:
Signed:	Modification certificate no.:	Modification plate no.:	Date:

Vehicle chassis no./VIN:	Date:	Signed: