



ARTSA, in conjunction with the Commercial Vehicle Industry Association of Australia (CVIAA), recently ran a 'Modifications and VSB6 Review Conference'. We did so with the active support and participation of the National Heavy Vehicle Regulator's (NHVR) office. The main business of the conference was to discuss the technical requirements in the National HV Modification Code (also called Vehicle Standards Bulletin No 6 – VSB6). The conference produced more than 300 pieces of feedback to the NHVR, which is currently reviewing VSB6. It also increased the understanding of the code for operators, workshop managers and vehicle engineers.

Compliance with VSB6 is mandatory for any modification that is described in VSB6. The National Heavy Vehicle Law prescribes a penalty of up to \$3,000 should a heavy vehicle be used that has been modified and not approved by an accredited person (AVE, or 'Approved Vehicle Examiner').

Because of the importance of VSB6 to our industry, ARTSA and CVIAA are pleased to provide a pull-out wall chart in this edition of *Prime Mover* magazine. The chart identifies the modifications that fall within the scope of VSB6. Please put it up in the workshop or in the operations room. Note that there are other VSBs and these can all be found on the website of the Department of Infrastructure and Regional Development,

Some key requirements in the modifications code – VSB6

under 'Vehicle Standard Bulletins'. AVEs will assess modifications according to the requirements in all the VSBs. This article outlines some key requirements – as many as space allows – that are in various sections of VSB6. If you intend to modify or arrange for modification of a heavy vehicle please find out what requirements are in VSB6 and get an AVE involved before you start.

'A' code pointers – engine substitution

- Engine emissions are often certified for maximum exhaust restriction and maximum air intake restriction (stated in kPa). These two restriction numbers cannot be exceeded at full load RPM. Restrictions should be measured.
- Suitable clearance is needed between the engine and features fixed to the chassis. A clearance of at least 10mm is required. In practice, 30mm is recommended.
- Exhaust clearances are essential to avoid fires. As a guide, a clearance of 150mm is needed between an exhaust and flammable material.

'S' code pointers – vehicle ratings

- A repowered vehicle should be able to maintain speed on a 23 per cent grade and move off on a 13 per cent grade. The powertrain – including the driveshaft – must be adequate.
- GVM is limited by chassis strength, brakes, axle group ratings or wheel and tyre ratings.

'E' code pointers – steering, wheels and tyres

- Avoid heat treating steering components that are case hardened because they can be weakened. This includes using induction heating to remove steering pins.
- Fasteners used on axles and steering components must be ISO grade 10.9 or SAE grade 8 (minimum).
- Steering (and suspension) clearances must be checked under simulation before the vehicle is driven.
- The force at the steering wheel to achieve a steering response must not be less than 5N and not more than 250N. During a simulated power steering failure the force must not exceed 600N.
- Offset rims change the weight distribution between inner and outer bearings. A de-rating factor may apply to the axle stub.

'K' code pointers – cabin modification

- An installed suspension seat with an integral seatbelt must withstand a net force that corresponds to 4.5kN for the lap and 4.5kN for the sash sections of the seatbelt plus 6.6 times the weight of the seat. Wheelchair anchor restraints must also withstand these forces.
- Seats and seatbelts must always be bolted onto structural cabin members. It is not adequate just to bolt a seat onto a floor.
- According to ADR 5/05, a seatbelt anchor can be bolted onto a metal plate of minimum thickness 3mm that is integrated into the cabin structure and has a minimum surface area of 3750mm².

'J' code pointers – body attachment

- Do not drill holes or weld the top or bottom flanges of the chassis rails.
- Body sub-frames must not create point stresses on the top flange of the rail. Affix a spacer or runner.
- Chassis rail strength: minimum Factor of Safety (FoS) is three. FoS is five for a lifting cross member. That is, the maximum rail stress (which probably occurs in the flanges) should be less than UTS stress/FoS.
- Gradual changes of strength are always preferred. Tapered ends on reinforcements are desirable.
- A suitably long and strong steel reinforcement (>1,500mm) is required at a lifting cross-member.
- Run the sub-frame the entire length of the body. Taper the ends.
- Side-plate attachments: attach the body (nominally) every 900mm.
- Attachment hardware for structural attachments must be at a minimum either metric grade 8.8 or SAE grade five.
- Bolts should be close fitting in holes. A nut-retention feature (preferably with a nylon insert) should be used.
- U-bolt attachments require internal spacers when used on C-channel rails. Additionally, two side plates/braces per side are also needed with U-bolts.
- For torsionally-stiff bodies, such as tankers or vehicles with very stiff sub-frames, the front attachments should be flexible. Otherwise cracking of the chassis rails may eventually occur.

'G' code pointers – brakes

- Changes to slack adjuster length, brake actuator size, friction material make or tyre diameter outside of the manufacturer's range constitute brake

modifications.

- Tests or calculations will often be needed to prove that a modified brake system produces vehicle deceleration according to the ADR 35/38 levels. This includes the truck-trailer compatibility limits in the design rules.
- Smaller tyres increase the brake force and larger tyres reduce the brake force.
- An additional air tank volume may be needed when a tow coupling is installed.
- The response time to the least favoured brake actuator cannot exceed 0.6 seconds.
- Mixing of brake actuator types in one group is poor practice. Do not mix disc and drum or hydraulic and electric in one axle group.
- If a Vehicle Stability Control (VSC) system or an Electronic Brake Control (EBS) system is installed, a set-up report using the supplier's test machine will be necessary.
- Protections and warnings should operate when the air pressure in the brake system drops below 420kPa (~65 per cent).
- The brake system must be favoured over accessories below a tank pressure of 450kPa.

'H' code pointers – chassis rail modifications

- Change of the wheelbase will usually require a change of steering arms, otherwise the front tyres will scrub.
- Rail joints should be reinforced – and the reinforcement must extend beyond the joint by at least twice the rail height.
- Rail joints should be tapered and welded on both sides. The edges must

be chamfered and professionally welded.

- Rail joints must be kept away from cross member locations. A separation of at least twice the rail height is needed.
- Chassis rail steel should be of the same grade when an extension is performed.
- Except for rail joints, welding on the top and bottom rail flanges is unacceptable.
- Hole centres through rails must not be closer than 50mm.
- Spring washers are not acceptable – locking nuts must be used.
- Suspension attachment points are high-stress locations for the chassis rails. Holes in the chassis rail flanges here will lead to cracking.
- A suspension chassis rail insert will probably be needed for a bogie rear axle group. It should extend at least 500mm beyond the attachment/hanger.

'P' code pointers – towing cross members and drawbars

- For tow ratings up to 23.5t, the towbar/drawbar and installation must withstand the following forces: longitudinally, 1.5 times the trailer total weight. Transversely, 0.5 times the trailer total weight. Vertically, 0.5 times the total trailer weight (for imposed load-type couplings).

'T' code pointers – tow trucks

- A load imposed on a towing frame must not unload the front axle to less than 60 per cent of the front axle tare weight.

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