# Queensland Code of Practice: Vehicle Modifications (QCOP)

## Code LR1: Installation of Vehicle Mounted Lifting Systems

Queensland Government

# CODE LR1

# Light Vehicle Modifications for the Installation of Vehicle Mounted Lifting Systems

## 1.0 Scope

The LR1 modification code specifies requirements for the installation of Vehicle Mounted Lifting Systems (VMLS) on specified light vehicles, that being vehicles having a Gross Vehicle Mass (GVM) rating that does not exceed 4,500 kg.

This code covers modifications to eligible light vehicles under the following Australian Design Rule (ADR) categories: MB, MC, MD1, MD2, MD3, NA and NB1. This code covers modifications for the installation of a VMLS that may or may not be applicable to an existing Australian Standard. This code does not cover the modifications related to cutting of the chassis to accommodate the installation of a VMLS, installations that does not meet its applicable Australian Standard or does not have an applicable Australian Standard but does not comply with this code, fitting of equipment that is not suitable for automotive use and the conversion of a motor vehicle into a dedicated self-propelled mobile crane.

The original vehicle manufacturer (OVM) refers to the entity holding the first stage Identification Plate Approval (IPA). An entity holding the Second Stage Manufacture (SSM) Approval or Registered Automotive Workshop Scheme (RAWS) Approval is not deemed as the OVM.

In cases where the OVM has not specified a GVM rating, the maximum laden mass at which the OVM has shown compliance with the ADRs is to be taken as the original GVM rating. This information must be obtained from a reliable and traceable source.

This code is not to be used for certifying modifications to new light vehicles before being provided to market in Australia. To certify modifications to heavy vehicles, that being vehicles that exceed 4,500 kg GVM or Aggregate Trailer Mass (ATM), refer to the *National Code of Practice for Heavy Vehicle Modifications* (VSB 6).

### 1.1 Modifications permitted under Code LR1

Modifications that may be certified under LR1 code are:

- Installation of VMLS that is certified under the requirements of *AS/NZS 1418 Cranes, hoists and winches*.
- Installation of VMLS that is not applicable to any existing Australian Standard, but the system and installation can meet the relevant requirements of this code.

### 1.2 Modifications not permitted under Code LR1

Modifications that must not be certified under LR1 code are:

- Modifications other than those described in Section 1.1.
- Modifications to vehicles that are not mentioned in Section 1.3.
- Cutting of the vehicle chassis to accommodate for the installation of a VMLS.
- Installation of a VMLS that has an applicable existing Australian Standard, but the installation and system does not meet the requirements of that standard.
- Installation of a VMLS that does not have an applicable existing Australian standard, but the installation and system does not meet the requirements of this code.
- Fitting of equipment that is not suitable for automotive use.
- Conversion of a motor vehicle into a dedicated self-propelled mobile crane.

- Fitting of lifting systems design to tow or transport vehicles.
- Reinforcement of a vehicle chassis to allow the installation of a VMLS.

### 1.3 Vehicle categories permitted to be certified under Code LR1

Modifications that may be permitted as described in Section 1.1 must be in one of the vehicle categories as specified by Table LR1-1.

**Table LR1-1 List of permitted vehicles for LR1 modification**

| Vehicle Category | Category Code |
|---|---|
| Forward-control passenger vehicle | MB |
| Off-road passenger vehicle | MC |
| Light omnibus<br>up to 3.5 tonnes GVM and up to 12 seats<br>up to 3.5 tonnes GVM and more than 12 seats<br>over 3.5 tonnes and up to 4.5 tonnes GVM | <br>MD1<br>MD2<br>MD3 |
| Light goods vehicle | NA |
| Medium goods vehicle<br>over 3.5 tonnes and up to 4.5 tonnes GVM | <br>NB1 |

## 2.0 General Requirements

Extensive modifications to a vehicle may affect the warranty provided by the OVM. It is the responsibility of the certifying Approved Person (AP) to consider the effect of the modification on warranty and clarify this point to the modifier and vehicle operator prior to modifications, if affected. Consideration of the effect this modification may have on product warranty is outside the scope of this code.

For audit purposes, sufficient documentary and photographic evidence of the modification must be retained by the certifying AP.

### 2.1 Compliance with applicable vehicle standards

**2.1.1** The modified vehicle must continue to comply with the ADRs that apply to it.

**2.1.2** If different or additional ADRs apply to the modified vehicle due to the modifications, the vehicle must comply with those ADRs that apply to it after modification.

**2.1.3** A modified vehicle must also comply with the applicable in-service requirements of the *Transport Operations (Road Use Management—Vehicle Standards and Safety) Regulation 2021* (the VSS regulation).

**2.1.4** A pre-ADR modified vehicle must continue to comply with the VSS regulation.

**2.1.5** Specific requirements, if listed in Section 3.0 of this code, take precedence over the requirements in Section 2.0, except for requirements based on applicable Australian Standards.

**2.1.6** Outlined in Table LR1-2 are areas of the vehicle that may be affected by the modifications and may require re-certification, testing and/or data to show compliance of the modified vehicle.

**Table LR1-2 List of items and likely affected ADRs**

| DETAIL | REQUIREMENTS |
|---|---|
| Lighting and Light Signalling Devices | ADR 13/.. |
| Rear Vision Mirrors | ADR 14/.. |
| General Safety Requirements | ADR 42/.. |
| Vehicle Configuration and Dimensions | ADR 43/.. |
| Omnibuses for Hire and Reward Requirements | ADR 58/.. |
| Mechanical Connections Between Vehicles | ADR 62/.. |

**Note:** This is not an exhaustive list and compliance to other ADRs may also be affected.

The ADR applicability is according to the vehicle's category and date of manufacture. It is the responsibility of the certifying AP to verify compliance to the applicable ADRs. The certification must include the vehicle date of manufacture in addition to the date of modification.

Sections 2.2 to 2.7 relate to the general requirements applying to different areas of the modifications under LR1 code.

## 2.2 Installation of a VMLS

**2.2.1** A relevant copy of AS/NZS 1418 must be readily available as additional requirements will require the standard.

**2.2.2** A VMLS that meets a category covered under AS/NZS 1418 must continue to comply with the relevant Australian Standard and meet requirements of this code.

**2.2.3** If the requirements between the relevant Australian Standard and this code conflicts, the Australian Standard takes precedence.

**2.2.4** The VMLS must be certified to the Australian Standard by a professional engineer registered with the relevant engineering registration body, or with a certificate from the VMLS manufacturer.

**2.2.5** A VMLS manufactured outside of Australia and meets a category covered under AS/NZS 1418 must provide equivalent or better results than the relevant AS/NZS 1418. This may include the VMLS manufacturer showing compliance to an equivalent of better international standard, provided modifications are

made to meet the other requirements of AS/NZS 1418, for example, showing compliance to EN12999 in place of AS/NZS 1418.11 with modifications for the additional requirements in AS/NZS 1418.11.

**2.2.6** If a VMLS does not meet any category covered under AS/NZS 1418, the installation must follow requirements of this code and be tested for its appropriate use.

## 2.3 Modifications for the installation of a VMLS

**2.3.1** If the vehicle chassis needs any reinforcement to allow the installation of a VMLS, this must be modified and certified under the LH13 and LH14 modification codes.

**2.3.2** The VMLS platform, linkage and structure must not be modified without written approval from the VMLS manufacturer.

## 2.4 Vehicle rating and dimensions

**2.4.1** All equipment, including the VMLS, when not in operation or deployed must meet all relevant ADRs with respect to configurations and dimensions, including protrusions and projections.

**2.4.2** If the vehicle fails to comply with the regulatory limits of the vehicle dimensions, do not perform or certify the installation.

**2.4.3** Axle, suspension and GVM capacity must not be exceeded for the selected VMLS.

**2.4.4** If necessary, the rated capacities above may be upgraded under the relevant modification codes, however, if an upgraded GVM exceeds 4,500 kg, the vehicle must be certified through the heavy vehicle modification code R1.

## 2.5 Fittings

**2.5.1** All bolts, fasteners and their respective safety design must meet the requirements of *Section LZ Appendix A – Fasteners* unless otherwise specified by the VMLS manufacturer or OVM.

**2.5.2** All bolts for the attachment of the VMLS must be tightened to the manufacturer's recommended torque or, if not available, the relevant Australian Standard.

**2.5.3** Suitable fasteners must be used for the VMLS attachment to prevent loosening.

**2.5.4** Substitute or additional hydraulic fittings, hoses and components must meet the same hydraulic standard and ratings as the existing equipment.

**2.5.5** Hydraulic components and fittings must be located away from the brakes and exhaust.

**2.5.6** Electrical and hydraulic service lines must be secured to prevent any mechanical damage.

**2.5.7** As required by AS/NZS 1418, all hydraulic VMLS must contain burst protection preventing any movement of any loadbearing hydraulic lines.

### 2.6 Lights and markers

**2.6.1** All existing and additional lamps and marker plates on the vehicle must meet visibility requirements of applicable ADRs, relevant standards, and regulations while the vehicle is in travel mode.

**2.6.2** Ensure, where necessary due to the vehicle dimensions, warning lights and/or reflectors are installed appropriately as per the relevant ADRs and standards.

### 2.7 General safety

**2.7.1** In-cab controls must not interfere with the driver's control of the vehicle.

**2.7.2** Safety devices that are incorporated in the VMLS must be operational.

**2.7.3** External vehicle controls should be installed in the left or rear of the vehicle.

## 3.0 Specific Requirements

The following specific requirements apply to all VMLS related modifications.

### 3.1 Location of VMLS

**3.1.1** Non-slewing platform type VMLS must be installed at the rear or left side of the vehicle.

**3.1.2** Other types of VMLS, not including platform types, should be installed at the left or rear of the vehicle if applicable.

**3.1.3** The VMLS must be installed where there is adequate clearance from vehicle moving parts including axles, brakes and suspension.

**3.1.4** The VMLS must be installed at a location that does not result in the vehicle load being unsafe or unstable.

**3.1.5** The mounting position of the VMLS should be installed at a location that allows easy inspection and maintenance of the mounting and adjacent vehicle parts.

### 3.2 Load distribution

**3.2.1** Before the loading of the VMLS, a weight distribution calculation must be performed to ensure that the axles will not be overloaded by the installation and the available payload is established where the loading and stability limitations are met.

**3.2.2** Load distribution calculations must be performed, with vehicles in any load condition and loader in the non-operating position, to ensure the minimum front axle load is suitable for effective steering and braking.

**3.2.3** For applicable non-slewing platform type VMLS, the chassis stress limit must not be exceeded when the tailgate loader is extended and at maximum load.

**3.2.4** For guidance on load distribution calculation, consult *VSB 6 – Section H*.

### 3.3 Chassis strength

**3.3.1** The chassis strength must be sufficient enough for static loads, loads during lifting and loads during travel.

**3.3.2** The OVM maximum allowable chassis stress level should not be exceeded when the loader is at the rated capacity. If the OVM has not specified a maximum allowable chassis stress level, the Factor of Safety must not be less than 3 and must be appropriate for installation.

**3.3.3** The VMLS should be held securely on the chassis or the body when subjected to forces of acceleration or deceleration, generated by the motion of the vehicle, of at least:

- $0.8 * g$ in the longitudinal directions,
- $0.5 * g$ in the lateral directions, and
- $0.2 * g$ relative to the load in the vertical direction in excess of g,

where *g* is the acceleration due to gravity.

**3.3.4** An appropriate Factor of Safety must be applied to the calculations above and the factored stresses must not exceed the yield strength of the materials being used.

**3.3.5** For guidance on calculations, consult *VSB 6 – Section H*.

### 3.4 VMLS attachment

**3.4.1** The attachment of the VMLS should be in accordance to the manufacturer's instructions and must meet requirements of AS/NZS 1418 as applicable.

**3.4.2** Brackets attached to the chassis in front of the rearmost suspension bracket or forward of the last 30% of the rear overhang must be bolted, not welded on.

**3.4.3** The loader and its components must withstand the rated capacity without causing permanent deformation or excessive deflection.

**3.4.4** Fastener tensile strength induced by the VMLS load moment must not exceed 20% of the material yield stress.

**3.4.5** A subframe may be fitted between the VMLS and chassis to distribute the load moment of the VMLS along the chassis side members.

**3.4.6** Attachment of the subframe must be in accordance with the LH13 and LH14 codes if applicable.

**3.4.7** The subframe and its attachment to the chassis should not excessively reduce the chassis flexibility. Check with the OVM on the usage of subframes as the OVM may prohibit the use of rigid subframes.

**3.4.8** Longitudinal and traverse movement must be prevented between the VMLS and the subframe.

**3.4.9** The mounting bolt layout must be in accordance with the VMLS manufacturer's technical guidelines, however, only a single layout can be used. Mixing or matching of multiple layouts is not permissible.

**3.4.10** Crossmembers should meet the requirements of the LH13 code.

### 3.5 Stability and axle loading

**3.5.1** A VMLS applicable to AS/NZS 1418 must meet the requirements of their applicable AS/NZS 1418 and take precedence over this section.

**3.5.2** The safe working load (rated operating capacity) must not be greater than 80% of the tipping load, that being the load which, if applied at the hook, tips the VMLS over.

**3.5.3** Vehicle loading VMLS must meet a satisfactory level of stability for all positions of the VMLS operation.

**3.5.4** Non-slewing VMLS must meet a satisfactory level of stability for positions that the VMLS is able to use.

**3.5.5** Where the VMLS is positioned at the front of the vehicle body, the stability must be considered at the worst-case position of the VMLS where the VMLS is extended in the forward, side in front of outrigger and side behind outrigger positions.

**3.5.6** Where the VMLS is positioned at the front of the vehicle body but offset to one side, the stability must be considered at the worst-case position extended at the side where the VMLS is installed.

**3.5.7** Where the VMLS is positioned at the rear of the vehicle body, the stability must be considered at the worst-case position of the VMLS where the VMLS is extended out the side in front of the outrigger or rearwards.

**3.5.8** Where the VMLS is positioned at the rear of the vehicle body but offset to one side, the stability must be considered at the worst-case position extended at the side where the VMLS is installed.

**3.5.9** Where the VMLS is positioned anywhere else, the stability must be considered at all configurations and critical situations with the VMLS extended.

**3.5.10** The installation stability must be tested to the requirements of the relevant sections of AS/NZS 1418.

## 4.0 Limitations

Section 1.2 of this code provides information about which types of modifications are not permitted to be certified under the LR1 code. In addition, the following limitations apply.

### 4.1 Electronic Stability Control (ESC)

If the vehicle is fitted with Electronic Stability Control (ESC) by the OVM, the following conditions must be met:

**4.1.1** The ESC system must not be disabled.

**4.1.2** It must be ensured that the modifications being certified do not reduce the effectiveness of the ESC system.

**4.1.3** The effect of the modification on the ESC system should be considered and recertified if deemed required.

## 5.0 Additional Modifications and Changes to Vehicle Category

**5.1** If additional modifications are made that may or may not be essential for the installation of a VMLS, all such modifications must be assessed separately and certified using appropriate codes or specific approvals. For example, a change in GVM would require certification under the LS11 and LS15 modification codes.

**5.2** If the vehicle's ADR category has changed due to a change in seating capacity or GVM, the vehicle must comply with the vehicle standards that apply to it in its new category. Certification under such compliance using the appropriate additional code(s) must be provided, for example, certification to the LO1 code, unless specific exemption has been granted for this purpose.

## Checklist LR1

## CODE LR1: Modification for the Installation of Vehicle Mounted Lifting Systems

Form No: LR1

Provide an answer to each of the following (N/A=Not Applicable, Y=Yes, N=No)

| **Modification Certificate Number:** | _____ | |
|---|---|---|
| **1** | **Modification details** | |
| 1.1 | Does the Vehicle Mounted Lifting System (VMLS) meet at least one of the following points?<br>• The VMLS is certified to an applicable AS/NZS 1418 standard(s); or<br>• The VMLS was manufactured outside of Australia, is applicable to a category of AS/NZS 1418 and provides equivalent or better results than the relevant AS/NZS 1418 standard (for example, showing compliance to an equivalent standard); or<br>• The VMLS is not in a category covered by AS/NZS 1418 but is installed in accordance with the specifications in this code. | ☐ Y<br>☐ N |
| 1.2 | Has the installation of the VMLS been performed in accordance with the manufacturer's recommendations and instructions? | ☐ Y<br>☐ N<br>☐ N/A |
| 1.3 | If the VMLS is certified to or applicable to any category of AS/NZS 1418, is the installation performed in accordance with the relevant AS/NZS 1418 and this code, with the requirements of the Australian Standard taking precedence? | ☐ Y<br>☐ N<br>☐ N/A |
| 1.4 | If the vehicle required any modifications outside of this code, has the vehicle been certified to those applicable modification codes? | ☐ Y<br>☐ N<br>☐ N/A |
| 1.5 | If the VMLS platform, linkage and/or structure has been modified, is there a copy of written approval from the VMLS manufacturer attached? | ☐ Y<br>☐ N<br>☐ N/A |
| **2** | **Bolts and fasteners** | |
| 2.1 | Do all bolts and fasteners meet the applicable requirements of *VSB 14 Section LZ Appendices – Appendix A Fasteners* unless otherwise specified by the VMLS or OVM manufacturer? | ☐ Y<br>☐ N |
| 2.2 | Have the bolts for the attachment of the VMLS tightened to the manufacturer's recommended torque or, if not available, the relevant Australian Standard? | ☐ Y<br>☐ N |
| 2.3 | Have suitable fasteners been chosen for the use of VMLS attachment to prevent loosening? | ☐ Y<br>☐ N |

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| | | |
|---|---|---|
| 2.4 | Has an insulating compound, or other means of preventing corrosion, been applied when bolting components of dissimilar metals? | ☐ Y<br>☐ N<br>☐ N/A |
| **3** | **Vehicle rating and dimensions** | |
| 3.1 | Does the vehicle, with the VMLS and equipment not in operation or deployed, meet all relevant ADRs with respect to configurations and dimensions, including protrusions and projections? | ☐ Y<br>☐ N |
| 3.2 | For the selected VMLS, are the axle, suspension and GVM capacity within their respective rated capacities? | ☐ Y<br>☐ N |
| **4** | **Hydraulic Fittings** | |
| 4.1 | Do all substitute or additional hydraulic fittings, hoses and components meet the same hydraulic standard and ratings as the existing equipment? | ☐ Y<br>☐ N<br>☐ N/A |
| 4.2 | Are all hydraulic hoses secure and clear of all moving components and do they have satisfactory ground clearance? | ☐ Y<br>☐ N<br>☐ N/A |
| 4.3 | As required by AS/NZS 1418, does the hydraulic VMLS contain burst protection preventing any movement of any loadbearing hydraulic lines? | ☐ Y<br>☐ N<br>☐ N/A |
| 4.4 | Is the hydraulic system free from fluid leaks? | ☐ Y<br>☐ N<br>☐ N/A |
| **5** | **VMLS installation** | |
| 5.1 | Are all platform type VMLS installed at the rear or left-hand side of the vehicle? | ☐ Y<br>☐ N<br>☐ N/A |
| 5.2 | Is the VMLS installed at a position with adequate clearance from the vehicle moving parts and at a location that does not result in the vehicle load being unsafe or unstable? | ☐ Y<br>☐ N |
| 5.3 | Is the VMLS mounted on a suitably designed subframe? | ☐ Y<br>☐ N<br>☐ N/A |
| 5.4 | Has the OVM maximum allowable chassis stress level not been exceeded when the loader is at the rated capacity or, if the maximum has not been specified, is the chassis stress level below one third of the chassis material yield stress when the loader is at the rated capacity? | ☐ Y<br>☐ N |

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| | | |
|---|---|---|
| 5.5 | Has the VMLS and its components been installed in a way that, when loaded at rated capacity, does not cause permanent deformation or excessive deflection? | ☐ Y<br>☐ N |
| 5.6 | Does the method used to install the VMLS to the chassis or subframe meet the requirements of the OVM's instructions or, if not available, has it been ensured that the vehicle has sufficient chassis reinforcement within the chassis frame design limits to withstand the load moment induced by lifting? | ☐ Y<br>☐ N |
| 5.7 | Does the VMLS meet the relevant testing requirements of AS/NZS 1418? | ☐ Y<br>☐ N<br>☐ N/A |
| 5.8 | Does the vehicle meet a satisfactory level of stability for relevant positions or worst-case positions of the VMLS when extended and at their rated capacity? | ☐ Y<br>☐ N |
| **6** | **Electronic Stability Control (ESC)** | |
| 6.1 | If fitted, is it ensured that the ESC system is not disabled? | ☐ Y<br>☐ N<br>☐ N/A |
| 6.2 | If fitted, is it ensured that the ESC system is not made less effective due to modifications carried out under this code? | ☐ Y<br>☐ N<br>☐ N/A |
| **7** | **ADR Compliance** | |
| 7.1 | Does the modified vehicle continue to comply with all affected Australian Design Rules (ADRs)? | ☐ Y<br>☐ N |
| **8** | **Workmanship** | |
| 8.1 | Is the quality of the workmanship to a satisfactory industry standard? | ☐ Y<br>☐ N |

**Note:** If the answer to any question is **N (No)** the design cannot be certified under LR1 code.

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| CERTIFICATION DETAILS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Make** | | | | | **Model** | | | | | **Year of Manufacture** | | | | | | | |
| **VIN** | | | | | | | | | | | | | | | | | |
| **Chassis Number (If applicable)** | | | | | | | | | | | | | | | | | |
| **Brief Description of Modification/s** | | | | | | | | | | | | | | | | | |
| **Vehicle Modified By** | | | | | | | | | | | | | | | | | |
| **Certificate Number (If applicable)** | | | | | | | | | | | | | | | | | |
| **Vehicle Certified By (*Print*)** | | | | | | | | | | | | | | | | | |
| **Signatory's Employer (If applicable)** | | | | | | | | | | | | | | | | | |
| **Signatory's Signature** | | | | | | | | | | **Date** | | | | | | | |