

Vehicle Standard (Australian Design Rule 110/00 – Hydrogen-Fuelled Vehicle Safety Related Performance) 2023

Made under section 12 of the *Road Vehicle Standards Act 2018*

Explanatory Statement

Pending approval by the Hon Carol Brown MP, Assistant Minister Infrastructure and Transport

2023

CONTENTS

1.	LEGISLATIVE AUTHORITY	3
1.1.	National Road Vehicle Standards	3
1.2.	Exemption from Sunsetting	3
1.3.	International Harmonisation	4
1.4.	Hydrogen-Fuelled Vehicle Safety Related Performance	5
2.1.	Overview of the ADR	5
2.2.	Design Requirements Hydrogen-Fuelled Vehicle Safety Related Performance	5
2.3.	Hydrogen-Fuelled Vehicle Safety Related Performance - Warnings	6
2.4.	Requirements of Hydrogen-fuelled cell vehicles – Regards to its safety	7
2.5.	Exemptions and Alternative Procedures	8
2.6.	Alternative Standards	9
3.	MATTERS INCORPORATED BY REFERENCE	9
3.1.	Other Legislative Instruments	9
3.2.	Other Documents	10
4.	CONSULTATION	11
4.1.	General Consultation Arrangements	11
4.2.	Specific Consultation Arrangements	12
4.3.	Public Consultation	12
5.	REGULATORY IMPACT	12
6.	STATEMENT OF COMPATIBILITY WITH HUMAN RIGHTS	13
6.1.	Overview	13
6.2.	Human Rights Implications	13
6.3.	Conclusion	13

1. LEGISLATIVE AUTHORITY

1.1. National Road Vehicle Standards

Vehicle Standard (Australian Design Rule 110/00 – Hydrogen-Fuelled Vehicle Safety Related Performance) 2023, also referred to as ADR 110/00, is made under the *Road Vehicle Standards Act 2018* (RVSA). The RVSA enables the Australian Government to establish nationally uniform standards that apply to new road vehicles or road vehicle components when they are provided to the market in Australia. The RVSA applies to vehicles or components whether they are manufactured in Australia or imported.

The making of the vehicle standards necessary for the RVSA's effective operation is provided for in section 12, which empowers the Minister to "determine standards for road vehicles or road vehicle components".

1.2. Exemption from Sunsetting

ADR 110/00 is exempt from the sunsetting provisions of the *legislation Act 2003*. It is appropriate that standards made under section 12 of the RVSA, also known as the Australian Design Rules (ADRs), remain enduring and effective to regulate ongoing road worthiness of vehicles throughout their useful life and reduce regulatory burden on vehicle manufacturers.

Source of the Exemption

A standard made under section 12 of the RVSA is not subject to the sunsetting provisions of section 50 of the *Legislation (Exemptions and Other Matters) Act 2003* through section 12 of the *Legislation (Exemptions and Other Matters) Regulation 2015* (table item 56C). A similar exemption was previously granted in respect of national road vehicle standards made under section 7 of the *Motor Vehicle Standards Act 1989* (MVSA) (item 40, section 12 of the *Legislation (Exemptions and Other Matters) Regulation 2015*). This exemption is important to ensure that ADR 110/00 continues to remain in force, and available to regulators and industry.

Intergovernmental dependencies

The exemption concerns ADRs which facilitate the establishment and operation of the intergovernmental vehicle standard regime that Commonwealth, State and Territory governments rely on to regulate the safety of vehicles on public roads.

The Commonwealth uses the ADRs as the basis on which approvals to supply types of road vehicles to the market are granted under the *Road Vehicle Standards Rules 2019*. States and territories use the ADRs as the primary criteria on which vehicles are assessed for road worthiness. This 'in-service' aspect is dependent on the date of manufacture, which determines the applicable version of the ADGs against which the vehicle can be assessed. The ability to rely on national standards is particularly relevant given the long service life of vehicles – the average age of vehicles in Australia is 12.1 years.

While the ADRs are regularly updated to reflect changes in technology, it is not possible to apply these new standards retrospectively to vehicles that are already in use. With former ADRs kept on the Federal Register of Legislation, State and Territory governments can use them to ensure vehicles continue to comply with the ADRs that were in force when they were first supplied to the market.

In the event that the Commonwealth could not justify the maintenance of the ADRs, State and Territory governments would be compelled to create their own vehicle standards. Whilst this could mean adopting the substance of the lapsed ADRs as an interim measure, the differing needs and agendas of each State and Territory government may result in variations to in-service regulations. Having different vehicle standards across the states and territories would make the scheme operate contrary to the underlying policy intent of the RVSA which is to set nationally consistent performance-based standards.

Commercial dependencies

The effect on vehicle manufacturers to redesign existing models to comply with new ADRs would present a burden and be a costly and onerous exercise. Manufacturers should not be expected to continually go back to redesign existing vehicles. Furthermore, ongoing product recalls to comply with new ADRs would undermine consumer confidence with significant financial impact to manufacturers. This exemption allows vehicle manufacturers to focus their efforts to ensure new models supplied to the market continue to comply.

Effect on parliamentary oversight

The exemption from sunsetting does not mean that ADRs do not undergo regular evaluations. ADRs are subject to regular reviews, as resources permit, and when developments in vehicle technology necessitates updates to requirements. Comprehensive parliamentary scrutiny is available through these reviews.

Reviews of the ADRs ensure the ongoing effectiveness of a nationally consistent system of technical regulations for vehicle design, which are closely aligned, wherever appropriate with leading international standards such as United Nations regulations. This method facilitates the rapid introduction of the latest safety devices and technological advances into the Australian market, while also contributing to the industry's cost competitiveness in the domestic market.

1.3. International Harmonisation

A majority of Australian road vehicle standards such as ADR 110/00 harmonise closely with international regulations. This is so that manufacturers can more easily comply with regulation, and so that regulations capture the well-developed views of the international community. This ultimately leads to safer and cheaper products for Australians.

ADRs often directly incorporate United Nations (UN) Regulations as an appendix, where the appendix provides the technical requirements of the ADR and the rest of the ADR facilitates its application to Australia. To this end, Section 6 creates exemptions and alternate procedures. For instance, manufacturers are exempt from requirements that pertain to UN type approvals, and instead, need to comply with the approval process set out in the RVSA. Likewise, Section 7 provides for the acceptance of certain alternate standards that have equivalent requirements to the appendix. For instance, a vehicle covered by a type approval under the UN Regulation would be deemed to comply with the ADR.

1.4. Hydrogen-Fuelled Vehicle Safety Related Performance

All hydrogen-fuelled vehicles equipped with compressed hydrogen storage systems and specific components for compressed hydrogen storage systems must adhere to the safety related performance requirements in this standard.

2. PURPOSE AND OPERATION

2.1. Overview of the ADR

Clause 2.1 clarifies that this national road vehicle standard sets out requirements for passenger vehicles, light omnibus, heavy omnibus, light goods, medium goods and heavy goods vehicles with regard to the safety related performance of compressed hydrogen storage systems for hydrogen-fuelled vehicles and specific components for compressed hydrogen storage systems for hydrogen-fuelled vehicles.

The intent of the Hydrogen-Fuelled Vehicle Safety Related Performance is to ensure that vehicle occupants have safety protection during impact, as well as post-crash, protection against compressed hydrogen storage systems and specific components for compressed hydrogen storage systems for hydrogen fuelled vehicles.

2.2. Design Requirements Hydrogen-Fuelled Vehicle Safety Related Performance

Compressed hydrogen storage system consists of the high-pressure storage container and primary closure devices for openings into the high-pressure storage container. Compressed hydrogen storage system consisting of a pressurized container, three closure devices and their fittings. The closure devices shall include the following functions, which maybe combined:

- (a) Thermally-activated Pressure Relief Device (TPRD).
- (b) Check valve that prevents reverse flow to the fill line.
- (c) Automatic shut-off valve that can close to prevent flow from the container to the fuel cell or internal combustion engine. Any shut-off valve, and TPRD that form the primary closure of flow from the storage container shall be mounted directly on or within each container. At least one component with check valve function shall be mounted directly on or within each container.

The purpose of this requirement is to prevent any hydrogen fuel entering the vehicle's cabin space.

All new compressed hydrogen storage systems produced for on-road vehicle service shall have a Nominal Working Pressure (NWP) of 70 MPa or less and a service life of 15 years or less.

Clause 5.1 requires that all applicable vehicle fuel systems which include the compressed hydrogen storage system, piping, joints and components in which hydrogen is present meet the requirements set out in Appendix A of this standard, as varied by Section 6 Exemptions and Alternative Procedures. Appendix A is the UN Regulation No. 134 – UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES AND THEIR COMPONENTS WITH REGARD TO THE SAFETY-RELATED PERFORMANCE OF HYDROGEN-FUELLED CELL VEHICLES (HFCV) FOR M₁, M₂, M₃, N₁, N₂ and N₃ VEHICLES, incorporating the 01 series of amendments or alternative standard at clause 7.

2.3. Hydrogen-Fuelled Vehicle Safety Related Performance - Warnings

To inform the driver of a malfunction, a tell-tale signal warning is directed to the driver. The warning shall be given by a visual signal or display text with the following properties:

- (a) Visible to the driver while in the driver's designated seating position with the driver's seat belt fastened;
- (b) Yellow in colour if the detection system malfunctions (e.g. circuit disconnection, short-circuit sensor fault). It shall be red in colour if during operation a single failure results in a hydrogen concentration exceeding 3.0 per cent by volume in air in the enclosed or semi-enclosed spaces of the vehicle;
- (c) When illuminated, shall be visible to the driver under both daylight and night time driving conditions;
- (d) Remains illuminated when 3.0 per cent concentration or detection system malfunction exists and the ignition locking system is in the “On” (“Run”) position or the propulsion system is activated.

There shall be provisions for a label for hydrogen vehicles of categories light omnibus, heavy omnibus, medium goods vehicle and heavy goods vehicle:

- (a) The label shall be weather resistant;
- (b) The centre zone indicates the first energy source;
- (c) The upper zone indicates the second energy source;
- (d) The left zone indicates the gas behaviour due to density;
- (e) The right zone indicates the state of aggregation of storage gaseous fuel;
- (f) Layout and symbols shall be in accordance with ISO 17840-4:2018;
- (g) The colour and dimensions of the label shall fulfil the following requirements:

Colours:

- Background: Light blue, RGB code 0, 176, 240
- Border: white reflecting
- Letters and symbols: white reflecting
- Dimensions:
- Sticker width: ≥ 110 mm
- Sticker height: ≥ 80 mm

2.4. Requirements of Hydrogen-fuelled cell vehicles – Regards to its safety

The hydrogen storage system shall meet the performance test for on-road service:

- (a) Verification tests for baseline metrics
 - Baseline initial burst pressure
 - Baseline initial pressure cycle life
- (b) Verification test for performance durability (sequential hydraulic tests)
 - Proof pressure test
 - Drop (impact) test
 - Surface damage
 - Chemical exposure and ambient temperature pressure cycling tests
 - High temperature static pressure test
 - Extreme temperature pressure cycling
 - Residual proof pressure test
 - Residual strength Burst Test
- (c) Verification test for expected on-road performance (sequential pneumatic tests)
 - Proof pressure test
 - Ambient and extreme temperature gas pressure cycling test (pneumatic)
 - Extreme temperature static gas pressure leak/permeation test (pneumatic)
 - Residual proof pressure test
 - Residual strength burst test (hydraulic)
- (d) Verification test for service terminating performance in fire
- (e) Requirements for primary closure devices

This ensures integrity and fail-safe operations of hydrogen components.

Post-crash fuel system integrity: this requirement is deemed to be met if the vehicle equipped with vehicle fuel system which includes the compressed hydrogen storage system, piping, joints and components in which hydrogen is present is approved in accordance with UNRs:

- (a) Frontal impact test in accordance with either UN R 12, or UN R94; and
- (b) Lateral impact test in accordance with UN R95.

In case that one or both of the vehicle crash tests specified in the above UNRs are not applicable to the vehicle, the vehicle fuel system shall, instead, be subject to the relevant alternative accelerations. The accelerations shall be measured at the location where the hydrogen storage system is installed. The vehicle fuel system shall be mounted and fixed on the representative part of the vehicle. The mass used shall be representative for a fully equipped and filled container or container assembly.

Accelerations for vehicles of categories MA, MB, MC and NA:

- (a) 20 g in the direction of travel (forward and rearward direction);
- (b) 8 g horizontally perpendicular to the direction of travel (to left and right).

Accelerations for vehicles of categories MD and NB:

- (a) 10 g in the direction of travel (forward and rearward direction);
- (b) 5 g horizontally perpendicular to the direction of travel (to left and right).

Accelerations for vehicles of categories ME and NC:

- (a) 6.6 g in the direction of travel (forward and rearward direction);
- (b) 5 g horizontally perpendicular to the direction of travel (to left and right).

2.5. Exemptions and Alternative Procedures

Exemptions

Section 6 creates exemptions from some requirements of Appendix A (UN R134) which pertain to gaining a Type Approval in the UN context. This is because they are not required in the Australian context where the Commonwealth administers approvals through the RVSA and the ADRs. Consequently, manufacturers supplying new vehicles to Australia are exempt from most administrative (non-technical) requirements of UN R134.

Clause 6.1 states that, sections 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and annex 1 part 1 and part 2 of UN R134 are not required for the purposes of complying with ADR 110/00. This is because they refer to gaining a Type Approval in the UN context.

Alternative Procedures

Section 6 identifies procedures to which vehicles may comply, which are acceptable alternatives to those created by UN R134. These have been adapted for the Australian market to enable vehicle manufacturer to demonstrate compliance to ADR 110/00 where they have not gained a type approval in the UN context.

Clauses 6.2 states that ADR 110/00 applies to vehicles seeking to demonstrate that they meet all the technical requirements for Hydrogen-Fuelled Vehicle Safety Related Performance in post-crash fuel system integrity.

2.6. Alternative Standards

Section 7 sets out standards which are considered to be equivalent to ADR 110/00. If a vehicle meets the requirements of one of these standards, it also complies with ADR 110/00. These alternative standards are acceptable because they do not compromise the performance requirements set out in UN R134. Vehicle manufacturers have the flexibility to gain compliance to ADR 110/00 through clause 5.1 and Appendix A as varied by Section 6 Exemptions and Alternative Procedures, or through Section 7 Alternative Standards.

Clause 7.1 for vehicles equipped with Compressed Hydrogen Storage Systems (CHSS) including components for compressed hydrogen storage systems for hydrogen-fuelled vehicles, identifies the United Nations Regulation No. 134 – UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES AND THEIR COMPONENTS WITH REGARD TO THE SAFETY-RELATED PERFORMANCE OF HYDROGEN-FUELLED VEHICLES (HFCV), incorporating the 01 series of amendments are deemed to be equivalent to the technical requirements of this standard.

Clause 7.2 for vehicles equipped with Compressed Hydrogen Storage Systems (CHSS) including components for compressed hydrogen storage systems for hydrogen-fuelled vehicles, the technical requirements of United Nations Global Technical Regulation No. 13 HYDROGEN AND FUEL CELL VEHICLES, are deemed to be equivalent to the technical requirements of this standard.

3. MATTERS INCORPORATED BY REFERENCE

3.1. Other Legislative Instruments

Clause 4.1.2 of ADR 110/00 includes a reference to the Vehicle Standard (Australian Design Rule Definitions and Vehicle Categories) 2005 (which may also be cited as the Australian Design Rule – Definitions and Vehicle Categories). This sets out definitions for many terms used in the ADRs, including the vehicle categories used in ADR applicability tables.

ADR 10/... – Steering Column, which prescribes the minimum performance requirements for steering mechanisms for passenger cars, forward-control passenger vehicles, off-road passenger vehicles and light goods vehicles to minimise crushing or penetrating injuries to drivers due to the steering column as a result of frontal impact.

ADR 72/... – Dynamic Side Impact Occupant Protection, which prescribes crashworthiness requirements for passenger cars, forward-control passenger vehicles, off-road passenger vehicles (other than omnibus) and light goods vehicles to minimise the likelihood of injury to occupants in side impact.

ADR 73/... – Offset Frontal Impact Occupant Protection, which prescribes crashworthiness requirements for passenger cars to minimise the likelihood of injury to occupants in offset frontal impacts.

The ADRs may be freely accessed online through the Federal Register of Legislation. The website is www.legislation.gov.au.

In accordance with subsection 12 of the RVSA, each of these ADRs are incorporated as in force or existing from time to time. The ellipses (...) indicates the version(s) (e.g. 00, 01 etc.) of the ADR in force at the time.

3.2. Other Documents

American Society for Testing and Materials

Paragraph 1.4 and 2.4 of Appendix A Annex 4 includes references to the American Society for Testing and Materials (ASTM) B117. Standard practice for operating salt spray (Fog) apparatus.

Paragraph 2.6 of Appendix A Annex 4 includes references to ASTM D572, standard test method for rubber-deterioration by heat and oxygen. Component testing in accordance with ISO 1431/1, ASTM D1149, or equivalent test method.

ASTM B117, D572 and D1149 may be freely accessed online through the ASTM International Reading Room. This requires the user to register using an email and password. The ASTM International Reading Room website is www.astm.org/readinglibrary/.

In accordance with subsections 14(1)(b) and 14(2) of the *Legislation Act 2003*, each of these ASTM standards are incorporated as in force on the date this national road vehicle standard is made.

International Organization for Standardization

Paragraph 2.12 of Appendix A in Definitions, paragraphs 1, 1.1 and 2 of Appendix A Annex 4 with hydrogen gas having gas quality compliant with ISO 14687-2/SAE J2719.

Paragraph 2.6 of Appendix A Annex 4 ISO 1431/1, component testing in accordance with ISO 1431/1, ASTM D1149, or equivalent test methods.

Paragraph 7.1.7 of Appendix A Annex 6 ISO 17840-4:2018, layout and symbols.

ISO 14687-2, 1431/1 and 17840-4 are available for purchase only from the International Organization for Standardization (ISO) and various associated national standards bodies. While not freely available, these ISO standards are all readily accessible and widely used by vehicle manufacturers and test facilities as part of their professional libraries.

In accordance with subsections 14(1)(b) and 14(2) of the *Legislation Act 2003*, each of these ISO standards are incorporated as in force on the date this national road vehicle standard is made.

Clause 11 of the RVSA allows the Minister to incorporate a broad range of documents, both as in force at a particular time and as in force from time to time, when making national vehicle standards. This ensures that Australia's legislative framework is well-prepared for future developments in the international road vehicle space.

United Nations Regulations and/or Resolutions

Clauses 7.1 includes a reference to the 01 series of UN Regulation No. 134 – UNIFORM PROVISIONS CONCERNING THE APPROVAL OF MOTOR VEHICLES AND THEIR COMPONENTS WITH REGARD TO THE SAFETY-RELATED PERFORMANCE OF HYDROGEN-FUELLED CELL VEHICLES (HFCV) FOR M₁, M₂, M₃, N₁, N₂ and N₃ VEHICLES (UN R134). This is an international standard for Specific Requirements for passenger vehicles, light omnibus, heavy omnibus, light goods, medium goods and heavy goods vehicles with regard to the safety related performance of compressed hydrogen storage systems for hydrogen-fuelled vehicles and specific components for compressed hydrogen storage systems for hydrogen-fuelled vehicles.

The Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, and the UN Regulations (including UN R12, R94, R95, and R134), may be freely accessed online through the UN World Forum for the Harmonization of Vehicle Regulations (WP.29). The WP.29 website is www.unece.org/trans/main/welcwp29.html.

In accordance with subsections 14(1)(b) and 14(2) of the *Legislation Act 2003*, each of these UN documents are incorporated as in force on the date this national road vehicle standard is made.

4. CONSULTATION

4.1. General Consultation Arrangements

It has been longstanding practice to consult widely on proposed new or amended vehicle standards. For many years, there has been active collaboration between the Commonwealth and the state/territory governments, as well as consultation with industry and consumer groups. Much of the consultation takes place within institutional arrangements established for this purpose. The analysis and documentation prepared in a particular case, and the bodies consulted, depend on the degree of impact the new or amended standard is expected to have on industry or road users.

Proposals that are regarded as significant need to be supported by a Preliminary Assessment (PA) meeting the requirements of the Office of Impact Analysis (OIA) as published in the *Australian Government Guide to Regulatory Impact Analysis* or the *Regulatory Impact Analysis Guide for Ministers' Meetings and National Standard Setting Bodies*.

4.2. Specific Consultation Arrangements

A PA conducted by the Department identified that regulatory and trauma savings and productivity gains would be achieved, by ensuring that an ADR for Hydrogen-Fuelled Vehicle Safety Related Performance is implemented prior to the predicted increase in Hydrogen-Fuelled Fuel Cell Vehicle sales in Australia. This increase is based on the global transition to Zero Emission Vehicles and aligns with the Australian Government’s objectives to reduce road trauma, provide certainty for industry and transition the fleet to Zero Emission Vehicles. The Department undertook consultation through the Technical Liaison Group (TLG) and the Strategic Vehicle Safety and Environment Group (SVSEG) members in which full support of implementation of Hydrogen-Fuelled Vehicle Safety Related Performance ADR.

TLG consists of technical representatives of government (Australian and state/territory), the manufacturing and operational arms of the industry (including organisations such as the Federal Chamber of Automotive Industries and the Australian Trucking Association) and of representative organisations of consumers and road users (particularly through the Australian Automobile Association).

SVSEG consists of senior representatives of government (Australian and state/territory), the manufacturing and operational arms of the industry and of representative organisations of consumers and road users (at a higher level within each organisation as represented in TLG).

4.3. Public Consultation

A public consultation for Hydrogen-Fuelled Vehicle Safety Related Performance was posted on the Department’s website for an eight-week public comment period, which closes on 27 March 2023.

5. REGULATORY IMPACT

Mandating an ADR for Hydrogen-Fuelled Vehicle Safety Related Performance, will have a positive net benefit to the economy due to the safety requirements in the UN Regulation. A Preliminary Assessment (OIA22-03727) conducted by the Department considered the impacts of mandating a new ADR on a “must comply, if fitted” basis for Hydrogen-Fuelled Vehicles. The impacts were considered minor in nature on industry while market penetration of HFCVs are still low in Australia. This view is supported by the light and heavy vehicle industry.

Based on the information provided, OIA determined the proposal is unlikely to have a more than minor regulatory impact, as all light HFCV suppliers and most heavy HFCV suppliers already meet UN Regulation No. 134 that this ADR would align with. Further, if regulatory action is not taken, the future is likely to involve fragmented state/territory safety standards for ‘in-service’ use of HFCVs. While the avoided cost of complying with multiple standards could be significant, the costs of future regulatory activities of states and territories is beyond the scope of Commonwealth impact analysis. As such, the preparation of an Impact Analysis (IA) is not required by the OIA.

6. STATEMENT OF COMPATIBILITY WITH HUMAN RIGHTS

The following Statement is prepared in accordance with Part 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

6.1. Overview

ADR 110/00 specifies requirements for passenger vehicles, light omnibus, heavy omnibus, light goods, medium goods and heavy goods vehicles with regard to the safety related performance of compressed hydrogen storage systems for hydrogen-fuelled vehicles and specific components for compressed hydrogen storage systems for hydrogen-fuelled vehicles.

The purpose of the regulation is to protect occupants against hydrogen fuel leakage and hydrogen storage systems and ensure the post-crash safety of road vehicles.

6.2. Human Rights Implications

As such, ADR 110/00 does not engage any of the human rights and freedoms recognised or declared in the international instruments listed in section 3 of the *Human Rights (Parliamentary Scrutiny) Act 2011*.

6.3. Conclusion

ADR 110/00 is compatible with human rights, as it does not raise any human rights issues.