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Data entry – draft starts next page

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0.1	22/07/2024	Initial draft generated from the published document in new RISSB format

Preface

This standard was prepared by the Audible Warning Devices Development Group, overseen by the RISSB Rolling Stock Standing Committee.

Objective

The objective of this Standard is to describe the requirements for audible warning devices for the following types of rolling stock:

- Locomotives
- Self-propelled passenger rolling stock driving vehicles including driving vehicles on a push/pull set
- Infrastructure maintenance rolling stock vehicles
- Light rail vehicles and trams
- Road/rail vehicles

The main purpose of the requirements is to ensure that the design is suitable to allow the audible warning device to operate as an effective safety system and, where possible, minimize adverse impacts of noise to nearby communities.

This Standard is intended to compliment the rolling stock compliance certification process outlined in AS 7501, including all vehicle types such as new, modified and heritage rolling stock.

Compliance

There are four types of provisions contained within Australian Standards developed by RISSB:

(a) Requirements.
(b) Recommendations.
(c) Permissions.
(d) Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term ‘shall’.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred.
Recommendations are identified within the text by the term ‘should’.

Recommendations recognize that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term ‘may’.

Constraints – provided by an external source such as legislation. Constraints are identified within the text by the term ‘must’.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities or interfacing organisations where the risk may be shared.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix A.

Appendices in RISSB Standards may be designated either “normative” or “informative”. A "normative" appendix is an integral part of a Standard and compliance with it is a requirement, whereas an "informative" appendix is only for information and guidance.

Commentary

Commentary *C Preface*

This Standard includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

Table of Contents

Tables

Section 1 Scope and general

1.1 Scope

This document applies to new and modified rolling stock.

The document covers the design, construction and maintenance of rolling stock.

Operation of rolling stock regarding network safe working rules, procedures and route standards is not covered.

Commentary *C1.1*

The RISSB Code of Practice – Rail traffic horn use, provides guidance on the use of the audible warning devices.

This Standard is not specifically intended to cover rolling stock used on cane railways and automatic train operations, but items from this Standard may be applied to such systems as deemed appropriate by the relevant RTO.

This Standard excludes door warning alarms, rolling stock initiated automated alarms and messages, crew mouth operated whistles and bell messages between crew members.

1.2 Normative references

The following documents are referred to in the text in such a way that *some* or all of their content constitutes requirements of this document:

- Australian Design Rule 42/04, *General safety requirements*
- Australian Design Rule ADR 94/00 – *Audible warning*
- AS 2377, *Acoustics – Methods for the measurement of rail bound vehicle noise*
- AS 7513 Series, *Railway Rolling Stock – Interior Environment*
- AS 7520 Series, *Rolling stock – Body structural requirements*
- EN 15153-4, *Railway applications – External visible and audible warning devices - Part 4: Audible warning devices for urban rail*

NOTE:
Documents for informative purposes are listed in a Bibliography at the back of the Standard.

1.3 Defined terms and abbreviations

For the purposes of this document, the following terms and definitions apply:

1.3.1
acoustic startle response
largely unconscious defensive response to a sudden loud sound

1.3.2
ADR
Australian design rules applied to road vehicles

1.3.3
ARL
above rail level

1.3.4
high horn
audible warning device with a sound intensity level defined in this Standard, that is intended for main line operation where a higher sound level is required. Sound generating device may be pneumatic, electric or a combination. Also, **country warning device**

Note to entry: Country warning device, both in labelling and terminology, is still used by some RTOs. High horn is the RISSB standard term now being applied. The reason for using the term high horn instead of country horn is to remove the misconception that it was only operated in country areas.

1.3.5.
low horn
audible warning device with a sound intensity level defined in this Standard, that is intended for use where a lower sound level is required when compared with the high horn. Sound generating device may be pneumatic, electric or a combination. Also, **town warning device**

Note to entry: Town warning device, both in labelling and terminology, is still used by some RTOs. Low horn is the RISSB standard term now being applied. The reason for using the term low horn instead of town horn is to remove the misconception that it was only operated in town areas.

1.3.6
LRV
light rail vehicle

1.3.7
quadricycle
small self-propelled rail bound vehicle used for conveying personnel, tools, or equipment along the track. A quadricycle may be hand powered or fitted with an engine

1.3.8
RRV
road rail vehicle

1.3.9
RTO
rail transport operator

1.3.10
yard warning device
warning device that is intended for use by rail vehicles in depots, yards or workshops where horn volume as deemed by the operator and/or local noise restrictions would adversely affect local residents or workers in the vicinity and thus lower horn volumes apply as specified in this standard

General rail industry terms and definitions are maintained in the RISSB Glossary. Refer to: https://www.rissb.com.au/glossary/

Section 2 Audible warning device requirements – General requirements

Rolling stock shall have audible warning devices fitted at each leading end.

Commentary *C2-1*

Some locomotives are fitted with a single audible warning device but having directional horns facing the directions of travel (i.e. opposing horns). These types of audible warning devices installed on locomotives could be acceptable if allowed by the RIM and noise test compliant.

Interior noise from audible warning devices shall comply with AS 7513.

Audible warning devices shall be installed upon a suitable mount which meets the appropriate shock and vibration requirements of AS 7520 with the air supply (if used) connected by a flexible hose.

The housing for the audible warning devices should be designed to minimize acoustic obstruction in the intended direction of sound transmission and, where applicable, reducing noise emissions in other directions.

Commentary *C2-2*

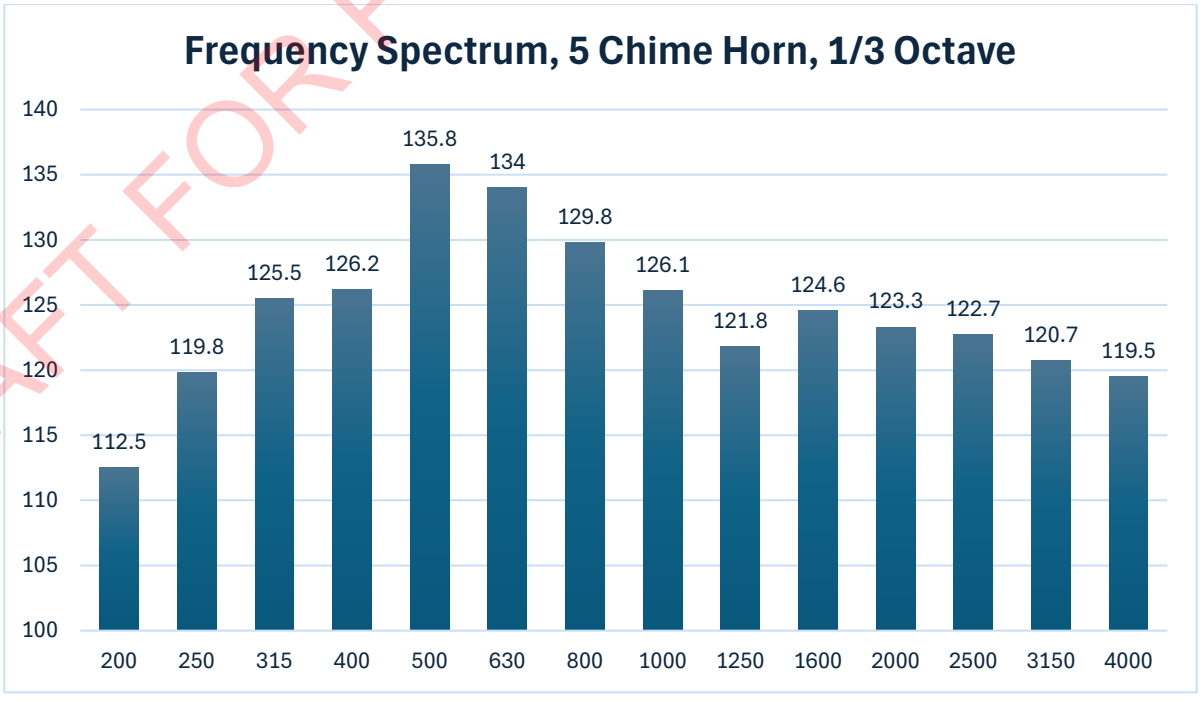
The harmonic quality of audible warning devices could have a negative impact on nearby communities. Audible warning devices that balance audibility for safety of rail operations whilst minimizing community noise disturbance could be considered during design of the audible warning system.

The frequency spectrum of audible warning devices on rail vehicles should be able to be differentiated from other sounds such as emergency vehicle sirens, active railway level crossings, traffic light pedestrian signals and general road vehicle horns. The audible warning device should provide a spectrum which is rich in harmonics to optimize audibility for persons with partial hearing loss.

Commentary *C2-3*

EN 15153-2 and EN 15153-4 provide guidance on frequencies that could be applied to audible warning devices.

The 5-chime horn type (example below) can be another method of achieving a distinct audible warning.



The use of adaptive audible warning devices that automatically adjust the sound level based on the background ambient noise should be utilized where possible.

For rolling stock that operates in urban areas or other areas where audible device noise may have a negative effect on nearby communities, the design of the audible warning device should minimize the acoustic startle response.

Commentary *C2-4*

Acoustic warning devices produce large pulses of noise, which can cause an acoustic startle response in people exposed to the sound. This may increase the disturbance caused to nearby communities. The startle response could be avoided by increasing the rise time of the sound (i.e. the time it takes to reach maximum intensity), which could be suitable for routine uses of acoustic warning devices.

Final Report - iMOVE 6-011 Train Horn - Broader Social Effects and Pedestrian Simulations could be considered when assessing potential train audible warning device effects on communities.

The audible warning devices shall be maintained and inspected such that the specified sound levels are assured throughout the operational phase of the asset life cycle.

RTOs shall have appropriate controls in place to ensure safe rail vehicle operation when the audible warning devices fail during operations.

The supplier’s data should be referenced to establish the predicted life of the audible warning device.

The supplier’s data should be referenced for the maintenance requirements of an audible warning device.

Section 3 Noise test procedure

3.1 General

Audible warning devices shall be subjected to a type test on each vehicle to ensure compliance with the requirements of this Standard as part of vehicle testing and commissioning and the results documented. The type testing shall be conducted on all operator cabs.

Type testing shall occur on:

(a) all new vehicles;

(b) if the vehicle has been modified where modification may affect compliance with this Standard;

(c) if the vehicle has been involved in an accident; or

(d) if the audible warning device has been replaced or repaired.

RTOs shall use a risk-based approach to determine routine testing requirements and frequency of testing. This shall be incorporated into the maintenance plan to ensure the audible warning devices maintain compliance with this Standard.

The routine testing of audible warning devices (e.g., in yards and maintenance facilities) should minimize adverse impacts of noise to nearby communities, where possible.

Commentary *C3.1*

It is understood that testing of audible warning devices is an important safety function to confirm operation. Procedures or alternatives to limit the noise impact to nearby communities especially during night/early morning operations could be developed by RTOs.

Refer to AS 7531 for requirements for flashing lights to be activated when the audible warning device is sounded.

3.2 Locomotives, passenger and infrastructure rolling stock

The audible warning device noise level shall be measured with equipment, acoustical environment and in meteorological conditions in accordance with the stationary vehicle test method defined in AS 2377.

NOTE:

AS 2377 states that horns are not to be operating, however they need to be fully functional to undertake this test.

For pneumatically operated audible warning devices, the testing shall be undertaken with the vehicle main reservoir air pressure charged to the operational range.

The audible warning device shall be operated 3 times. The duration of each measurement sample shall be not less than 5 s and not greater than 10 s. For a compliant test, the spread of the values recorded during the samples shall not exceed 3 dB(A).

The noise level shall only be measured at a single point which is 30 m +/- 0.2 m in front of the leading end of the vehicle at a height of 1.5 m +/- 0.2 m from top of rail.

3.3 Light rail vehicles and trams

LRV's and trams shall be tested in accordance with:

(a) ADR 94/00 for ADR compliant devices, and

(b) EN 15153-4 for other warning devices.

3.4 ADR compliant warning devices

ADR compliant warning devices shall be tested in accordance with ADR 94/00.

Section 4 Locomotives and passenger rolling stock

NOTE:

Passenger rolling stock in this section excludes LRVs and trams.

Locomotives with one cab only that may operate in either direction shall have a bi- directional audible warning device installed (i.e. an audible warning device at each end of the locomotive). Single cab locomotives with bi-directional horns should only operate the horn on the end of the direction of travel.

Controls shall be provided which allow the driver to operate the high horn and low horn individually. Controls may be provided which allow both high horn and low horn to operate simultaneously from the one controller.

Where a control lever is used the high horn should operate for backward movement of control lever, and low horn for forward movement. A combined horn of low and high (if fitted) should operate by movement of the control lever to the left or right.

The noise levels of the audible warning devices with the rolling stock stationary shall achieve a steady tone compliant with the test distance values in Table 4-1.

Table 4-1 Audible Warning Device Tabulated Values

Rolling stock audible warning device requirements			
	Distance ahead of rolling stock @ 1.5 m ARL		
	30 m (test distance)	**25 m (for information)**	**200 m (for information)**
High horn maximum value	110 dB(A)	111 dB(A)	93 dB(A)
High horn minimum value	106 dB(A)	108 dB(A)	88 dB(A)
	Distance ahead of rolling stock @ 1.5 m ARL		
	30 m (test distance)	**25 m (for information)**	**100 m (for information)**
Low horn maximum value	101 dB(A)	103 dB(A)	90 dB(A)
Low horn minimum value	95 dB(A)	97 dB(A)	85 dB(A)
	Distance ahead of rolling stock @ 1.5 m ARL		
	30 m (test distance)	**25 m (for information)**	**1 m (for information)**
Yard warning device maximum value	80 dB(A)	82 dB(A)	110 dB(A)
Yard warning device minimum value	75 dB(A)	77 dB(A)	105 dB(A)

Commentary *C4*

Values for alternate distances from the front of the rail vehicle are provided for comparison information only.

Section 5 Infrastructure maintenance rolling stock

5.1 Warning horns

Infrastructure maintenance rolling stock that can operate as a lead vehicle with a maximum speed of 30 km/h or more shall be fitted with a low horn.

Infrastructure maintenance rolling stock that can operate as a lead vehicle with a maximum speed of 30 km/h or more and operate outside of urban areas shall also be fitted with a high horn.

Powered quadricycles shall be fitted with an ADR compliant audible warning device.

5.2 Reversing and movement awareness alarms

To protect personnel who may work on the ground in the vicinity of the machine, infrastructure maintenance rolling stock should be fitted with a warning beeper that sounds when a change of direction is made in work mode.

The beeper shall sound for two seconds and be at least 10 dB(A) above vehicle noise at 5 m from the machine.

Infrastructure maintenance rolling stock that continually change direction as part of the normal work function may be exempted in work mode provided that suitable controls are in place to protect personnel on the ground.

5.3 Infrastructure plant start- up warning devices

A warning device shall be fitted to sound before remotely starting or operating equipment that could injure workers in the vicinity for a duration appropriate to allow workers to move to a position of safety.

The warning device shall produce a sound pressure level of the greater of 85 dB(A) or 10 dB(A) above any potential background noise in the vicinity.

Section 6 Road rail vehicles

6.1 Warning horns

Audible warning devices for road registered RRVs shall comply with ADR 42/04 and ADR 94/00.

For non-road registerable RRV units, an audible warning device capable of achieving a sound pressure, as a minimum, equal to that of the ADR requirements shall be fitted to RRVs.

6.2 Reversing and movement awareness alarms

RRVs shall be fitted with reversing alarms which projects noise in the vehicle direction of travel.

RRVs which frequently operate in bi-directional mode shall be fitted with a movement awareness alarm which projects noise in the vehicle direction of travel.

A movement alarm may also perform the function of the reversing alarm.

Reversing and/or movement awareness alarms shall be automatically activated when travel is in the reverse direction.

Reversing and movement awareness alarm should be of the ‘white noise’ or ‘squawker’ type and be adaptive to emit alarm noise at a set level above ambient background noise.

Commentary *C6.2*

There are no prescribed sound power level requirements for such alarms, however a basic guide could be an intermittent audible signal of a minimum level of 90 dB(A) at 1 m in the direct of travel.

Alternatively, there are units available that automatically adjust the sound level based on the background ambient noise. These adaptive devices emit a sound pressure level that could be, for example, 5dB(A) above the ambient noise level, up to a set maximum level.

‘White noise’ or ‘squawker’ style alarms can be preferred for RRVs operating in built-up or urban areas to minimize adverse impacts of noise to nearby communities

Section 7 Light rail vehicles and trams

LRV's and trams operating in areas predominately shared by road vehicles and pedestrians:

(a) shall have a warning horn compliant to ADR 42/04 and ADR 94/00 for a heavy omnibus;

(b) may have a warning horn compliant with the requirements of EN 15153-4 for devices for medium-range audible warning; and

(c) shall have a warning bell compliant with the requirements of EN 15153-4 for devices for medium-range audible warning.

Commentary *C7-1*

ADR compliant warning horns are the minimum requirement for LRVs and trams operating in shared traffic areas. A warning horn compliant with the requirements of EN 15153-4 for devices for medium-range audible warning is an option that would also comply with the ADRs.

The warning horn and warning bell shall be separately activated from each operating cab and activate in the direction of travel of the LRV or tram.

LRV's and trams operating in segregated areas not shared by road vehicles and pedestrians may have:

(d) a warning horn compliant with the requirements of EN 15153-4 for devices for alerting / drawing attention at short range; and

(e) a warning bell compliant with the requirements of EN 15153-4 for devices for alerting / drawing attention at short range.

The audible warning device sound output should be directional. The AF-weighted maximum sound pressure level (i.e. LpAFmax) when measured at 90 degrees and 7 m distance to the left and right of the LRV/tram cab should be at least 5 dB(A) lower than the level measured at 7 m directly in front of the LRV/tram.

The audible warning devices should be geolocated to enable reduction of sound levels when operating near sensitive receiver locations and/or during night operations when ambient noise is reduced.

Commentary *C7-2*

Geolocation may be via GPS, infrastructure mounted balise tag, distance based or a combination.

The intent of these requirements is to minimize adverse impacts of noise to nearby communities.

Appendix A Hazard Register (Informative)

Hazard Number	Hazard
5.3.1.3	Rolling Stock - Harm to persons - Derailment or Collision, Human Error, Track Failure, Design Failure, Health, Organisational SMS Failure, Security Breaches, Loads not Secure and or Vandalism - Bodily impact
5.3.1.7	Rolling Stock - Harm to persons - Derailment or Collision, Human Error, Track Failure, Design Failure, Health, Organisational SMS Failure, Security Breaches, Loads not Secure and or Vandalism - Persons being crushed
5.3.1.39	Rolling Stock - Harm to persons - Derailment or Collision, Human Error, Track Failure, Design Failure, Health, Organisational SMS Failure, Security Breaches, Loads not Secure and or Vandalism - Harmful exposure to noise
5.4.1.2	Rolling Stock - Derailment or Collision, Human Error, Track Failure, Track Obstruction, Design Failure, Health Failure, Organisational SMS Failure, Security Breach, Load not Secure and or Vandalism - Derailment
5.5.1	Rolling Stock - Harm to Rolling Stock Related Processes - Derailment or Collision, Human Error, Track Failure, Track Obstruction, Design Failure, Health Failure, Organisational SMS Failure, Security Breach, Load not Secure and or Vandalism
5.8.1.18	Rolling Stock - Collision - Derailment, Human Error, Track Failure, Track Obstructions, Design Failure, Health Failure, Organisational SMS Failure, Security Breach, Load not Secure and or Vandalism - Poor audibility of trains - causing collision with infrastructure maintenance rolling stock, the result of an inadequate train separation system
5.18.1.5	Rolling Stock - Level crossing collision - Derailment, Human Error, Track Failure, Track Obstructions, Design Failure, Health Failure and or Vandalism - Poor audibility of trains (Train issues)
5.18.1.6	Rolling Stock - Level crossing collision - Derailment, Human Error, Track Failure, Track Obstructions, Design Failure, Health Failure and or Vandalism - Poor audibility of trains (Did not hear train - Road vehicle or pedestrian issues)
5.34.1.2	Rolling Stock - Poor train audibility - Human Error, Design Failure, Health Failure, Organisational SMS Failure and or Vandalism - Train horns or reversing beepers being faulty
5.34.1.3	Rolling Stock - Poor train audibility - Human Error, Design Failure, Health Failure, Organisational SMS Failure and or Vandalism - Train horns or reversing beeper tone(s) not being noticeable
5.34.1.4	Rolling Stock - Poor train audibility - Human Error, Design Failure, Health Failure, Organisational SMS Failure and or Vandalism - Train horns or reversing beepers being not fitted
5.34.1.9	Rolling Stock - Poor train audibility - Human Error, Design Failure, Health Failure, Organisational SMS Failure and or Vandalism - Device design output being insufficient affecting the device sound power output resulting in train horns not being loud enough

Hazard Number	Hazard
8.4.1.1	Operations - Injury or Death of an Employee - Derailment or a Collision, Human Error, Track Failure, Track Obstruction, Design Failure, Health Failure, Organisation's SMS Failure, Environmental Impact, Security Breach, Load not Secure and or Vandalism - Being struck by rail traffic
8.5.1.1	Operations - Injury or Death of a third Party - Derailment or a Collision, Human Error, Track Failure, Track Obstruction, Design Failure, Health Failure, Organisation's SMS Failure, Environmental Impact, Security Breach, Load not Secure and or Vandalism - Being struck by trains

Bibliography (Informative)

- AS 7501, *Railway Rolling Stock Compliance Certification*
- AS 7531, *Rolling stock lighting and visibility*
- EN 15153-2 - *Railway applications - External visible and audible warning devices - Part 2: Warning horns for heavy rail*
- RISSB Code of Practice - *Rail Traffic Horn Use*
- Final Report - *iMOVE 6-011 Train Horn - Broader Social Effects and Pedestrian Simulations*