Bus door safety systems

1. Scope

1.1. This Technical Specification (TS) 155 sets the criteria for the design of a bus door safety system which is intended to prevent persons from being injured, potentially fatally, by a passenger door in a bus

1.2. A door safety system meeting the criteria in this TS 155 will incorporate:

- A door sensor system to detect a door obstruction
- A driver warning system with visual and audible alarm
- A door brake system to stop the bus from moving or stop it if already moving
- An acceleration control system to limit a vehicle's engine revolutions.

1.3. The door safety system will limit the door opening and closing force and, if the door sensor system detects an object, control the movement of the bus and warn the driver. This will prevent injury in any situation.

2. Application

2.1. This TS 155 is approved under clause 26 of the *Road Transport (General) Regulation 2013* and applies to buses that seat more than 25 people including the driver which:

- Are used by an accredited service operator to operate any regular passenger service * within the meaning of the *Passenger Transport Act 1990*
- Have been first registered on, or after, 01 July 2018
- Are fitted with a driver controlled passenger door

  Note *: A regular passenger service is one with buses operating where the carriage of passengers for a fare or other consideration is conducted according to regular routes and timetables but does not include a tourist service or a distance service.

3. Definitions and interpretation

3.1. Accelerator control system – means the subsystem of the door safety system that prevents the driver from increasing the engine revolutions above idle speed

3.2. Bus – means a bus and coach covered under this TS 155 in accordance with 2.1 of this specification

3.3. Door brake system – means the subsystem of the door safety system that stops the bus from moving

3.4. Door controls – means all buttons and switches, other than driver door controls, that may be used to operate any driver controlled passenger door

3.5. Door safety system – means the system that controls the operation and features of a driver controlled passenger door

3.6. Door safety system manufacturer – means the company or entity integrating all the components comprising of the door safety system in the manufacture of a bus (or retrospectively if a bus has been previously registered without a system installed)

3.7. Door sensor system – means the subsystem of the door safety system used to detect a door obstruction

3.8. Driver controlled passenger door – means any passenger door provided for the entry and exit of passengers during normal operation of a bus operated by the driver in the driver's cabin

3.9. Driver door controls – means all buttons and/or switches used by the driver in the driver's cabin to operate a driver controlled passenger door

3.10. Driver warning system – means the visual and audible means of alerting a driver to an abnormal condition or a system fault affecting the door safety system

3.11. Electronic Braking System (EBS) – means an electronically controlled braking system

3.12. Front door – means the forward passenger door which is located no further back than the seating row behind the driver and which is in clear view of the driver

3.13. Non-reopening door system – means a door system that is not designed to reopen the doors in the event a door obstruction is detected

3.14. Operating and Maintenance (O&M) Documentation – means all written or electronic instructions, manuals, training materials and other documentation recommended by the door safety system manufacturer to enable safe operation and maintenance of each bus. O&M documentation, as it applies to door safety system manufacturers, includes, but is not necessarily limited to:

- Recommended maintenance, servicing, inspection and adjustment instructions, servicing and inspection schedules and intervals, and detailed compliance test procedures and methods
- Required inventory catalogue and specialised test equipment.

3.15. Pre-set speed – is the speed set (nominally up to 10 km/h) that influences the control of various subsystem functions of the door safety system

3.16. Reopening door system – means a door system designed to automatically reopen the doors in the event a door obstruction is detected

3.17. Safe state of operation – a design state where, in the event of any failure in a system or one of its components, the system or component or other inter-related systems or components will operate in a way that prevents or mitigates unsafe or intolerable consequences of the failure.

4. General requirements

4.1. Each driver controlled passenger door will be incorporated into a door safety system as described in this TS 155

4.2. A sticker (or stickers) will be affixed to the side window next to the driver similar to the example below. The text which is visible from the outside of the bus will read, "Do Not Access Bus Through Window".

5. Door safety system

5.1. The operation of the door safety system will not affect the compliance of the bus with any Australian Design Rule or applicable regulation

5.2. The door safety system will not prevent any internal emergency door controls from opening any passenger door when the bus is travelling below the pre-set speed

5.3. All components of a door safety system will be located or designed so that the risk of being tampered with is minimised

5.4. The door safety system will be designed to(in the event of any abnormal condition, system fault or failure)default to a safe state of operation

5.5. The door safety system will operate:

5.5.1. Without any driver intervention

5.5.2. Whenever the engine ignition key is in the 'ON' position

5.5.3. Whenever there is sufficient energy, in the case of a stored energy system, to operate any door.

5.6. The door safety system will deactivate the door sensor system when the bus is travelling above the pre-set speed

5.7. The door safety system must incorporate a 'maintenance isolation' switch to enable the system to be deactivated and allow a vehicle to be driven, under controlled conditions, to a place of repair

5.7.1. The maintenance isolation switch must be concealed behind a panel that is not accessible from the driving position

5.7.2. The door safety system will provide a means of recording and storing, for a predetermined length of time, data relating to the application of the maintenance isolation switch.

5.8. The door safety system must also feature a tamper-resistant 'emergency override' switch to allow a vehicle to be driven to a safe location in the event of an emergency

5.8.1. The emergency override switch must be accessible from the driving position and must return immediately to the off position on release to deactivate the override function

5.8.2. Activation of the emergency override switch will produce a visible and audible alert to the driver

5.8.3. The door safety system will provide a means of recording and storing, for a predetermined length of time, data relating to the application of the emergency override switch

5.9. When the door sensor system activates, the door safety system will only be capable of being reset by:

- A reapplication of the door controls
- A separate door reset button.

A further application of the door control would then be required to close the doors

5.10. The steady force applied to an object located at any vertical position between closing doors, or the leading edge of a single closing door and any part of the bus, will not exceed 200 N for a reopening door system and 150 N for a non-reopening door system, when measured from 20 mm to 300mm from the fully closed position, as demonstrated in Appendix A – Typical two leaf door configuration closing force test methodology.

5.11. The door safety system must have a means to minimise the risk of the door from being forced or blown open in operation above the pre-set speed. For this purpose the door holding force may increase, as required, above the 150 N closing force after the bus has reached the pre-set speed

5.12. Opening force for inward opening doors must not exceed 150 N up to 300mm from any bus body fixture that could cause passenger entrapment. For systems incorporating a door sensor system on the door opening cycle, the opening force won't exceed 200 N up to 300mm from any bus body

fixture that could cause passenger entrapment. In the case of doors with passenger handles, These forces can be exceeded to aid stability. This can only be done when the door is stationary and in the fully open position

5.13. The correct operation of the door safety system can be readily checked without dismantling any component

5.14. The door safety system will be capable of operating reliably under the full range of likely environments encountered during bus operation. This includes extremes of temperature and cleaning with pressurised water. For example, rubber or plastic components might perform differently over a range of temperatures affecting the flexibility of a door seal.

6. Door sensor system

6.1. Any door may automatically reopen when the door sensor system detects an obstruction

6.2. The door sensor system must activate when the driver door controls are activated and remain active until the doors are closed and the bus moves off and reaches the pre-set speed

6.3. The door sensor system will conform with the requirements contained in Appendix B – Typical two leaf door configuration sensor system test methodology of this TS 155

6.4. The door sensor system will be capable of detecting a solid rod used to obstruct the doors in accordance with Appendix B – Typical two-leaf door configuration sensor system test methodology of this TS 155.

7. Door brake system

7.1. When any driver door control has been activated to open any door, and until all doors have closed without the door sensor system detecting an object, the door brake system will prevent movement of the bus by:

- Mechanically or electronically securing the engine in idle mode
- Applying the brakes on at least one axle or by locking the driveline.

7.2. The door safety system will only release the door brake system, if no object has been detected, after:

- The doors have fully closed
- The handbrake is released
- A secondary activation of either the foot brake or the engine accelerator is applied.

7.3. The door brake system used to control the bus brakes or driveline retarding device will be designed so it doesn't activate while the bus is travelling in excess of the pre-set speed

7.4. The door brake system will be designed to hold a stationary bus on a 12 per cent gradient while fully laden

7.5. The door brake system should be capable of stopping a bus travelling under the pre-set speed smoothly without locking the wheels and within a reasonable distance.

8. Accelerator control system

8.1. The accelerator control system will only release after the doors have fully closed and after a secondary activation of either the foot brake or the engine accelerator

8.2. The door safety system will activate the accelerator control system whenever any driver controlled passenger door is opened.

9. Driver door controls

9.1. The driver door controls will not operate unless the bus is stationary

9.2. The driver door controls will only close the doors if the handbrake is applied or the foot brake is depressed

9.3. If a driver door control lock is provided to prevent all passenger doors, other than the front door, being operated (for example, school special or charter) it will be located adjacent to the driver door controls

9.3.1. When the driver door controls lock has been activated a light adjacent to the driver door controls lock will illuminate to inform the driver the lock is activated

9.3.2. With the driver door controls lock activated it should be possible to close any open rear or centre passenger door. It must not be possible to open these doors with the driver door controls

9.3.3. Activation of the driver door controls lock should not affect the operation of the front passenger door.

10. Door controls

10.1. For doors that can be closed via an external door control, operation of these door controls will not close any door or deactivate the door brake system unless the handbrake is applied

10.2. Where buses have an external mechanism that allows the doors to be manually shut, the door brake system will not deactivate unless the handbrake is applied

10.3. If any driver controlled passenger door fitted with a wheelchair ramp is open, and the ramp is deployed, the driver door controls should not be able to close the doors.

11. Driver warning system

11.1. The bus must also be fitted with a driver warning system comprising of an audible and visual alarm activating if the driver turns the vehicle off or removes the ignition key without the handbrake applied

11.2. The driver warning system will be activated by the door safety system when an abnormal condition is detected, such as the system not compling with this TS 155

11.2.1. If a bus is fitted with an Electronic Braking System (EBS), any active fault in the EBS that inhibits the operation of the door safety system or any of its sub-systems must activate the driver warning system

11.2.2. The visual indicator for the driver warning system will be located in the area of the driver's normal controls and be marked with or display the words 'DOOR ALARM'

11.2.3. Any audible warning device, as part of the driver warning system, which produces a recorded voice message will read , 'DOOR ALARM' and will repeat until the system is reset

11.3. The door safety system will also continually monitor its own state of operation and, if a fault does occur, must provide an audible and visual warning to alert the driver a fault has occurred.

12. Certification

12.1. The door safety system manufacturer will retain a certification confirming compliance of the system with this standard, completed by an appropriately competent person who is authorised by the door safety system manufacturer to confirm compliant manufacture of any bus. This will also be provided to the accredited service operator or owner of the vehicle

12.2. The door safety system manufacturer must provide operating and maintenance documentation applicable to the door safety system to the accredited service operator or owner of each bus

12.3. The door safety system will utilise the chassis Original Equipment Manufacturer's (OEM) supplied door brake system and accelerator control system whenever possible. The activation and use of these systems must always be in accordance with the OEM's recommendations, ADR compliance requirements and any applicable regulations

12.4. Where the door safety system is not in compliance with part 12.3 of this TS 155, certification is required by a person accredited as a licensed certifier under the *Roads and Maritime Vehicle Safety Compliance Certification Scheme (VSCCS)* – see VSCCS Bulletin No. 1 'Licensed Certifiers'.

Further Information

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- Vehicle construction and registration requirements in NSW

Roads and Maritime Vehicle Safety Compliance Certification Scheme (VSCCS)

www.rms.nsw.gov.au/vsccs

T: 1300 336 206

E: vsccs@rms.nsw.gov.au

VSCCS Bulletin No.1'Licensed certifiers'.

Appendix A – Typical two leaf door configuration closing force test methodology

Overview

The door closing force is determined by placing a force measuring device in the doorway so the door edges close onto the device.

Equipment

The force measuring device will be capable of measuring a compression force between two surfaces. The device will measure force up to at least 500 N.

Typical test procedure

1. Close the doors onto the device. Use spacers when necessary to set the required test gap between the door edges
2. Observe and record the force reading
3. Repeat steps one and two for required test heights above the doorstep.

Note: In order to assess the correct closing force exerted by the door(s) it might be necessary to disarm, override or bypass some of the automatic functions of the door safety system, such as the door sensor system. The force to be measured is the steady force generated by the closing door(s). The test is designed to confirm that, even if the door sensor system is not operating, the specified door closing forces are not exceeded.

For detailed instruction on test procedure refer to the door safety system manufacturer's operating and maintenance documentation.

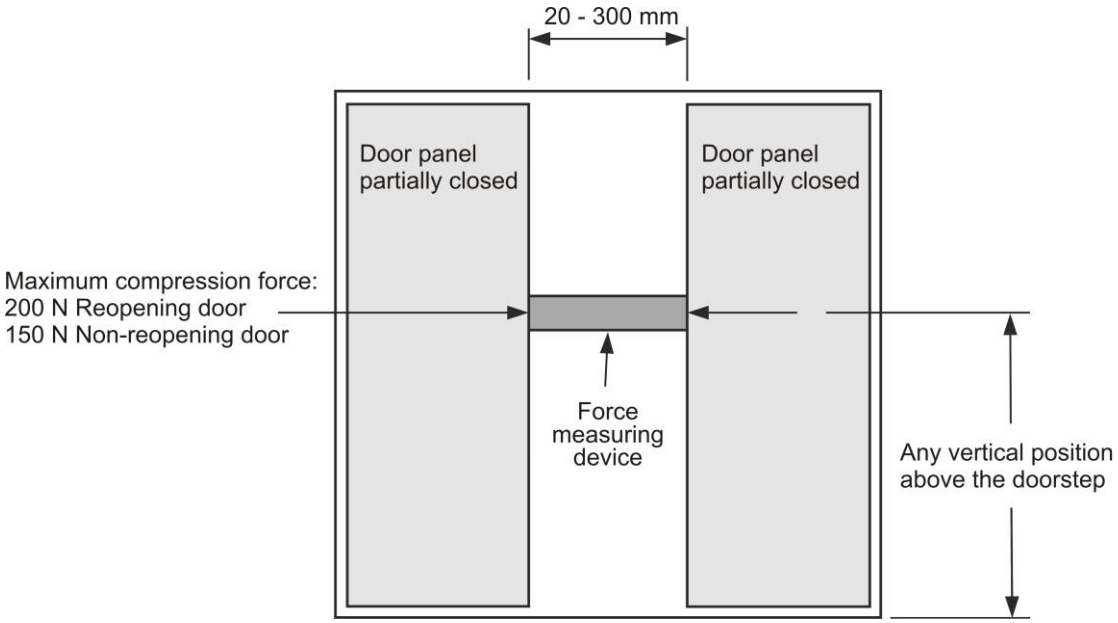

Figure 1 (not to scale)

Appendix B – Typical two leaf door configuration sensor system test methodology

Overview

A short length of solid rod, intended to represent the ankle and wrist of a child, is held firmly in the way of the closing door panels.

Equipment

The test device consists of a multi-diameter rod as illustrated in the diagram (Figure 2) on the following page. The 20mm diameter section is representative of a child's wrist and the 35mm diameter section, a child's ankle. At the lowest test height, the 35mm diameter section of rod is placed horizontally on the door step and between the closing doors. At all other test heights above the step, the 20mm diameter section of rod is placed between the closing doors.

Typical test procedure

1. Place the 35mm diameter end of the test rod on the door step so the door edges will only contact the same 35mm diameter section of the dowel. Ensure the dowel is positioned at right angles, horizontally and vertically, to the closed position of the doors
2. Close the doors onto the dowel
3. Observe whether the doors reopen when the edges of the doors reach the dowel (the reopening feature is optional)
4. Irrespective of whether the doors reopen, have the driver attempt to move the bus by selecting a forward gear, releasing the parking brake (if applied) and gently pressing the throttle
5. Observe whether the bus moves
6. If the doors are still closed, open them
7. Remove the dowel
8. Close the doors and have the driver attempt to move the bus by gently pressing the throttle. It should move, indicating that the safety system has deactivated
9. Repeat steps one to nine for additional heights using the 20mm diameter section of the rod (for example, approximately 750mm and 1500mm above the step). The actual test heights should be somewhat random to ensure that no system is only sensitive at defined test heights.

For detailed instruction on test procedure refer to the door safety system manufacturer's operating and maintenance documentation.

Continued – Figure 2

Appendix B – Typical two leaf door configuration sensor system test methodology

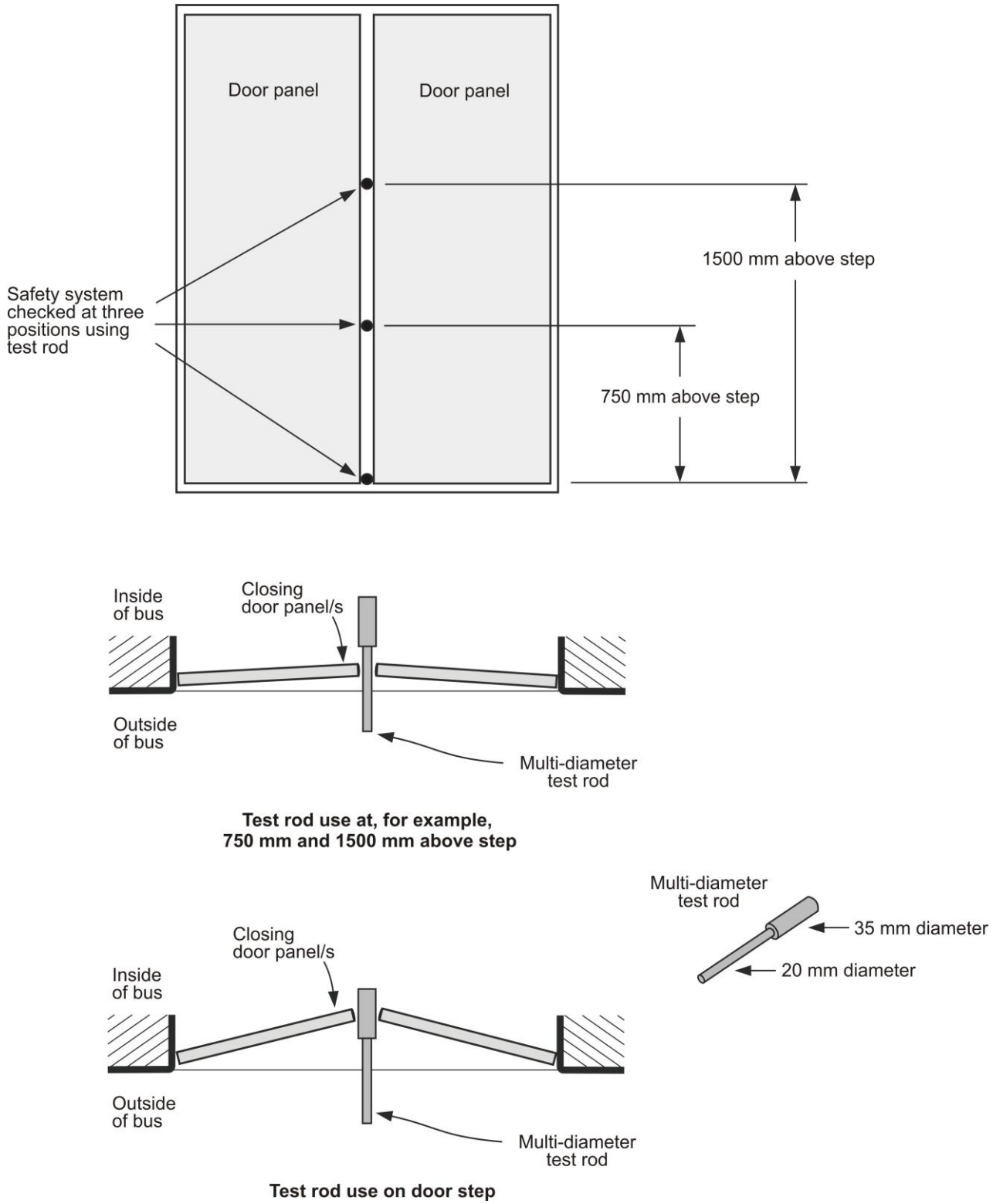

Figure 2 (not to scale)