



MOTOR VEHICLE STANDARDS ACT  
A national standard determined under section 7 of the Act  
**AUSTRALIAN DESIGN RULE 31/00**  
**HYDRAULIC BRAKE SYSTEMS FOR PASSENGER CARS**

## COVER SHEET

This is a national standard under section 7 of the Motor Vehicle Standards Act 1989 and is part of the Australian road vehicle standards system.

This rule was first approved as a national standard on 30 November 1989 in Road Vehicle (National Standards) Determination No. 3 of 1989. The determination was published in Commonwealth of Australia Gazette No. GN 48 of 13 December 1989.

This rule was first issued in December 1986.

Details of subsequent changes to this rule are shown on page (ii).

Vehicle category definitions are given in Subpart 2 of the “Definitions and Vehicle Categories” Part of this volume. Definitions of defined terms are given in Subpart 3 of that Part.

Defined terms are identified in the text of this rule (other than in the title and major headings) by being in italics, single quotation marks and by having the first letter of each main word capitalised.

Reference should also be made to the relevant Subparts of the “Information for Users” at the front of this volume with respect to units and abbreviations used in the the ADR system.

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### RULE DEVELOPMENT

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Determination No.	Date Approved by Minister	Gazettal No.	Date
1 of 1995	16 March 1995	P 12	31 March 1995

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### OUTLINE OF AMENDMENTS

Package 17 issue of the rule extends the rule to LEP vehicles fitted with passenger car type brake controls.

Determination No. 1 of 1995 issue of the rule alters the method for testing whether the service brake failure indicator lamp is functional, for vehicles with combined service brake failure and park brake indicator lamps.



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**A SHORT TITLE**

**A.1** This national standard may be cited as Australian Design Rule No. 31/00, Hydraulic Brake Systems for Passenger Cars.

**A.2** This national standard may also be referred to as ADR 31/00.

**B FUNCTION AND SCOPE**

The function of this national standard is to ensure safe braking under normal and emergency conditions for vehicles equipped with hydraulic service brakes.

**C APPLICABILITY**

**C.1 Applicability Summary**

**C.1.1** This national standard applies to the design and construction of vehicles set out in the table below.

**C.1.2** All LEP vehicles fitted with a single foot pedal controlling both front and rear service brakes are required to comply with this national standard. Other LEP vehicles must comply with ADR 33/... .

**C.2 Applicability Table**

<b>VEHICLE CATEGORY</b>	<b>VEHICLE CATEGORY CODE</b>	<b>MANUFACTURED ON OR AFTER</b>	<b>ACCEPTABLE PRIOR RULES</b>
Moped 2 wheels	LA	not applicable	
Moped 3 wheels	LB	not applicable	
Motor cycle	LC	not applicable	
Motor cycle and side-car	LD	not applicable	
Motor tricycle	LE		
	LEM	not applicable	
	LEP	1 July 1992	nil
	LEG	not applicable	
Passenger car	MA	1 July 1988	nil
Forward-control passenger vehicle	MB	not applicable	
Off-road passenger vehicle	MC	not applicable	
Light omnibus	MD	not applicable	
Heavy Omnibus	ME	not applicable	
Light goods vehicle	NA	not applicable	
Medium goods vehicle	NB	not applicable	
Heavy goods vehicle	NC	not applicable	
Very light trailer	TA	not applicable	
Light trailer	TB	not applicable	
Medium trailer	TC	not applicable	
Heavy trailer	TD	not applicable	

## 31.1 DEFINITIONS

Refer to DEFINITIONS AND VEHICLE CATEGORIES preceeding the ADRs in this volume.

## 31.2 DESIGN REQUIREMENTS

### 31.2.1 Service Brake System

**31.2.1.1** The vehicle must be equipped with a service brake system.

**31.2.1.2** The 'Control' by which the service brake system is actuated must be located so that it is readily accessible to the driver in the normal driving position.

**31.2.1.3** The service brake system must incorporate devices which compensate for any increased movement of its components arising from wear. Such devices must themselves contain provision for securing them throughout their working range in any position in which they may be adjusted to or to which they may themselves automatically adjust.

### 31.2.2 Parking Brake System

**31.2.2.1** The vehicle must be equipped with a parking brake system such that in the applied position retention is effected by mechanical means, and the braking effect of which is effected by:

**31.2.2.1.1** the frictional force developed between 2 friction surfaces; or

**31.2.2.1.2** the frictional force developed between 2 friction surfaces and a 'Parking Mechanism 31/00' incorporated in the transmission or transmission control, so designed that engagement of such mechanism must be effected before the ignition key can be removed from the ignition switch.

**31.2.2.2** The 'Control' by which the parking brake system is actuated must be located so that it is readily accessible to the driver in the normal driving position.

**31.2.2.3** The parking brake system must incorporate devices which compensate for any increased movement of its components arising from wear. Such devices must themselves contain provision for securing them throughout their working range in any position in which they may be adjusted to or to which they may themselves automatically adjust.

### 31.2.3 Service Brake Failure Indicator Lamp

**31.2.3.1** The vehicle must have one or more service brake failure indicator lamps. The indicator lamp must be activated whenever any of the following conditions occur whilst the ignition switch is in the "engine on" position:

- for a vehicle having a 'Split Service Brake System', any of conditions 31.2.3.1.1 and 31.2.3.1.4 or optionally any of conditions 31.2.3.1.3 and 31.2.3.1.4;

- for a vehicle not having a 'Split Service Brake System', any of conditions 31.2.3.1.2 and 31.2.3.1.4 or optionally any of conditions 31.2.3.1.3 and 31.2.3.1.4.

**31.2.3.1.1** when a pressure failure occurs in any part of the service brake system except for pressure failure caused by either:

- a structural failure of a housing that is common to 2 or more sub-systems; or

- failure of a vacuum component of a vacuum 'Brake Power Assist Unit'.

In the event of such failures, for the purpose of this clause the lamp activation requirement will be deemed to be satisfied if the lamp is activated before or upon application of:

**31.2.3.1.1.1** a differential line pressure of not more than 1.55 MPa between the active and failed brake systems;

**31.2.3.1.1.2** a pedal effort of 225 N in the case of unassisted service brake systems;

**31.2.3.1.1.3** a pedal effort of 115 N in the case of service brake systems with a 'Brake Power Assist Unit'; or

**31.2.3.1.1.4** when the supply pressure in a 'Brake Power Unit 31/00' drops to less than one half of the operating pressure.

**31.2.3.1.1.5** For the purposes of this clause, differential line pressure must be measured either at a master cylinder outlet, or at a slave cylinder outlet if the master cylinder controls a slave cylinder at a booster unit.

**31.2.3.1.2** When the supply pressure in any 'Brake Power Unit 31/00' drops to less than half of the operating pressure.

**31.2.3.1.3** When a drop in the level of brake fluid occurs in any master cylinder reservoir either to less than the 'Manufacturer's' designated minimum level or to less than 25 per cent of the reservoir fluid capacity whichever is the greater volume remaining.

**31.2.3.1.4** A total electrical failure in an 'Antilock System' or 'Variable Proportioning Brake System'.

**31.2.3.2** In the case where the master cylinder reservoir also contains fluid for the use of a system other than the brake system, the indicator system and the reservoir must be so designed that the indicator lamp will not be activated when there are any variations in the fluid level in that part of the reservoir provided exclusively for the use of the system other than the brake system.

**31.2.3.3** As a check of lamp function the indicator lamp must be so designed that it is activated:

**31.2.3.3.1** when the ignition switch is turned from the "engine off" position to the "engine on" position and the engine is not operating, and unless a failure of the type described in clause 31.2.3.1 exists in the service brake system, it must be deactivated when the engine is operating; or

**31.2.3.3.2** when the ignition switch is in the “engine start” position, and unless a failure of the type described in clause 31.2.3.1 exists in the service brake system, it must be de-activated upon return of the ignition switch to the “engine on” position; or

**31.2.3.3.3** when the ignition switch is in a position between the “engine on” position and the “engine start” position, that is designated by the ‘*Manufacturer*’ as a check position, and unless a failure of the type described in clause 31.2.3.1 exists in the service brake system, it must be de-activated upon return of the ignition switch to the “engine on” position; or

**31.2.3.3.4** when the ignition switch is in the “engine on” position and the park brake is engaged for cases where the Service Brake Failure Indicator Lamp and the Park Brake Indicator Lamp are combined.

**31.2.3.3.5** For the purpose of this clause, for vehicles equipped with an automatic transmission the activation as a check of lamp function is not required when the transmission control lever is in a forward or reverse drive position.

**31.2.3.4** The indicator lamp system must be so designed that once having been activated to signal a brake failure it must be activated whenever the ignition switch is in the “engine on” position and the fault remains uncorrected.

**31.2.3.4.1** In the case of a vehicle having a ‘*Split Service Brake System*’ the activated lamp may be steady-burning or flashing. At the option of the ‘*Manufacturer*’ the lamp must be labelled with at least the word “BRAKE” or the symbol for “BRAKE FAILURE” specified as Number 4.31 in International Standard ISO 2575-1982(E) - Road vehicles - Symbols for controls, indicators and tell-tales, placed either directly on the lens or adjacent to it in such a way that the label is illuminated by the same light source as the lens. The letters of the label must be not less than 3 mm high and must be of a contrasting colour to their background when illuminated. If the label is directly on the lens the colour of either label or lens must be red and if the label is not on the lens the colour of the lens must be red.

**31.2.3.4.2** In the case of a vehicle not having a ‘*Split Service Brake System*’ a device must be fitted which activates both a continuous or short period intermittent audible signal and a flashing indicator lamp. At the option of the ‘*Manufacturer*’ the lamp must be labelled with at least the words “STOP - BRAKE FAILURE” or the symbol for “BRAKE FAILURE” specified as Number 4.31 in the ISO document referred to in clause 31.2.3.4.1 placed either directly on the lens or adjacent to it in such a way that the label is illuminated by the same light source as the lens. The letters of the label must be not less than 6 mm high and must be of a contrasting colour

to their background. If the label is directly on the lens the colour of either label or lens must be red and if the label is not on the lens the colour of the lens must be red.

**31.2.3.4.3** In the case of a vehicle having an ‘*Antilock System*’ where the lamp or lens display is used exclusively for the ‘*Antilock System*’ and where there is a failure of the ‘*Antilock System*’ the vehicle can still meet the performance requirements of clause 31.3, the activated lamp may be steady burning or flashing. The lamp must be labelled with the word “ANTILOCK” or equivalent placed either directly on the lens or adjacent to it in such a way that the label is illuminated by the same light source as the lens. The letters of the label must be not less than 3 mm high and the lens and the letters must be of contrasting colours, one of which is red or yellow, when illuminated. If the label is directly on the lens the colour of either the label or lens must be red or yellow and if the label is not on the lens the colour of the lens must be red or yellow.

#### **31.2.4 Parking Brake Indicator Lamp**

**31.2.4.1** The vehicle must be provided with a lamp, which at the option of the ‘*Manufacturer*’, may be common with or distinct and separate from any service brake failure indicator lamp. The parking brake indicator lamp will be activated whenever the ignition switch is in the engine-on position and the parking brake is engaged. In the case of a common lamp, the lamp must be labelled with the word “BRAKE” or the symbol for “BRAKE FAILURE” specified as Number 4.31 in the ISO document referred to in clause 31.2.3.4.1 and in the case of a distinct and separate lamp, the lamp must be labelled with at least the words “PARK BRAKE” or “PARKING BRAKE” or the symbol for “PARKING BRAKE” specified as Number 4.32 in the ISO document referred to in clause 31.2.3.4.1 placed either directly on the lens or adjacent to it in such a way that the label is illuminated by the same light source as the lens. The letters of the label must be not less than 3 mm high and must be of a contrasting colour to their background when illuminated. If the label is directly on the lens the colour of either label or lens must be red and if the label is not on the lens the colour of the lens must be red.

#### **31.2.5 Reservoirs**

**31.2.5.1** In the case where the service brake system incorporates a master cylinder, any service brake sub-system serviced by the master cylinder must have either:

amended by Det. No. 1 of 1995

**31.2.5.1.1** a reservoir which contains fluid exclusively for the use of that service brake sub-system; or

**31.2.5.1.2** a reservoir which contains fluid for the use of 2 or more service brake sub-systems in which case that part of the reservoir capacity provided exclusively for the use of each service brake sub-system must be not less than the volume displaced by the master cylinder piston servicing the sub-system, during a full stroke of the piston.

**31.2.5.2** The capacity of each reservoir must be not less than the fluid displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoir move from a new-lining, fully-retracted position, as adjusted according to the *'Manufacturer's'* recommendations to a fully-worn, fully applied position.

For the purposes of this clause, "fully-worn" means that the lining is worn to whichever of the following conditions allows the greatest shoe or pad movement:

**31.2.5.2.1** level with rivet or bolt heads on riveted or bolted linings;

**31.2.5.2.2** within 0.8 mm of shoe or pad mounting surface on bonded linings or pads; or

**31.2.5.2.3** the limit recommended by the *'Manufacturer'*.

**31.2.5.3** Each *'Brake Power Unit 31/00'* must have a device for storing energy of capacity not less than the total capacity of the reservoirs required under clause 31.2.5.2 plus the fluid displacement necessary to charge the piston(s) or accumulator(s) provided for the purpose of storing energy.

**31.2.5.4** A statement specifying the type of fluid to be used in the brake system and displaying at least the words "WARNING. Clean filler cap before removing" must be permanently affixed, stamped, engraved or embossed with letters not less than 3 mm high, either on or partially within 150 mm of one brake fluid reservoir filler plug or cap and totally within 300 mm of all reservoir filler plugs or caps. If not stamped, engraved or embossed, the lettering must be of a contrasting colour to that of the background.

#### **31.2.6 Protection of System Using *'Stored Energy'***

**31.2.6.1** Any device for storing energy for the operation or to assist in the operation of the brake system, must be so protected that failure of the generating power unit of a *'Brake Power Unit 31/00'* supplying the energy does not result in depletion of the *'Stored Energy'*.

**31.2.6.2** In cases where the generating power unit of a *'Brake Power Unit 31/00'* supplies energy to other units, the design must be such that the *'Brake Power Unit 31/00'* is preferentially charged.

**31.2.6.3** In the case of a service brake system with a single *'Brake Power Unit 31/00'*, the design must be such that the device for storing energy must preferentially service the brake system if such device also services other systems. In the case of a service brake system with 2 or more independent *'Brake Power Units 31/00'*, the design must be such that at least one device for storing energy must preferentially service the brake system.

### **31.3 PERFORMANCE REQUIREMENTS**

**31.3.1** The vehicle must be capable of meeting the range of performance tests set out in the table of clause 31.3.2 subject to the general test conditions of clause 31.4 and the particular test conditions of clause 31.5. The sequence of testing must be in the order set out in the table except that the parking brake test may be conducted at any time within the sequence and items 4-24 may follow items 25-26.

**31.3.2 Performance Tests** - see Table 1

TABLE 1

Item No.	Series of Tests and Procedures	Initial Vehicle Speed <sup>##</sup> km/h	Minimum Average Deceleration m/s <sup>2</sup>	Vehicle Mass	Gear Selector Position
1	Pre-test Instrumentation Check	65 (max)	N.A.	N.A.	N.A
2	First Effectiveness Test	45-55 95-105	5.00 5.45	M M	Neutral
3	First Burnishing Procedure	55-65	N.A.	M	Drive
4	Second Effectiveness Test	45-55 95-105 125-135	5.45 5.75 5.45	M M M	Neutral
5	First Reburnishing Procedure	55-65	N.A.	M	Drive
6	Parking Brake	N.A.	N.A.	M&L	See Text
7	Third Effectiveness Test	95-105	6.00 5.75 if 'Max. Vehicle Speed 31/00' 55 km/h or less	L	Neutral
8	Partial Failure	95-105	2.55	M&L	Drive
9	Inoperative 'Brake Power Assist Unit or 'Brake Power Unit 31/00'	95-105	See text	M	Drive
10	First Base Line Check Procedure	45-55	See text	M	Drive
11	First Fade Test	95-105	See text	M	Drive
12	First Fade Recovery Procedure	45-55	See text	M	Drive
13	First Fade Recovery Test	45-55	See text	M	Drive
14	Second Reburnishing Procedure	55-65	N.A.	M	Drive
15	Second Base Line Check Procedure	45-55	See text	M	Drive
16	Second Fade Test	95-105	See text	M	Drive
17	Second Fade Recovery Procedure	45-55	See text	M	Drive
18	Second Fade Recovery Test	45-55	See text	M	Drive
19	Third Reburnishing Procedure	55-65	N.A.	M	Drive
20	Fourth Effectiveness Test	45-55 95-105 125-135 or 160 (Refer clause 31.5.20)	5.00 5.45 5.00 4.75	M M M M	Neutral " " "
21	Third Base Line Check Procedure	45-55	See text	M	Drive
22	Water Conditioning Procedure	5-10	N.A.	M	Drive
23	Water Recovery	45-55	See text	M	Drive
24	Water Recovery	45-55	See text	M	Drive
25	Spike Stops	45-55	N.A.	M	Neutral
26	Final Effectiveness Test	95-105	5.45	M	Neutral

**31.3.2.1** In the above table, the following comments apply:

**31.3.2.1.1** N.A. means no condition applicable

**31.3.2.1.2** Item Number also corresponds to sub-clause number of Clause 31.5; e.g. Item No 2 is described in Clause 31.5.2.

**31.3.2.1.3** M means *'Maximum Loaded Test Mass*

**31.3.2.1.4** L means *'Lightly Loaded Test Mass*

**31.3.2.1.5** <sup>##</sup> The initial vehicle speed must not be outside the range specified.

**31.3.3** The vehicle must be deemed to meet the range of performance tests if it meets the requirements of each particular test and completes the range without component failure. For the purpose of this Rule component failure means:

**31.3.3.1** the lining surface area of any single *'Friction Element'* is reduced by more than 10 per cent as a result of *'Friction Element'* tearout or detachment;

**31.3.3.2** detachment or malfunctioning of any mechanical component of the brake system; and

**31.3.3.3** there is visible evidence of brake fluid on the friction surface of the brake or at wheel cylinders or fluid line junctions.

#### **31.4 GENERAL TEST CONDITIONS**

**31.4.1** The ambient temperature at the test site must be within the range of 0 to 40° C .

**31.4.2** The ignition timing, engine idle speed and adjustable speed governor if fitted must be set to the *'Manufacturers'* recommendation.

**31.4.3** The tyres fitted to the vehicle must be inflated to the pressure, recommended by the *'Manufacturer'*, appropriate to the *'Maximum Loaded Test Mass'*.

**31.4.4** Except as required for instrumentation purposes, all vehicle openings other than fascia vents of through-flow ventilation systems and quarter vents of vehicles not fitted with such ventilation systems must be closed.

**31.4.5** Deceleration must be conducted on a test track or roadway that meets the following requirements:

**31.4.5.1** in the case of fade tests, the surface must be substantially level and any effective upward gradient between the start and end of the test must not exceed one per cent;

**31.4.5.2** in the case of all other deceleration tests, the upward gradient must not exceed one per cent.

**31.4.6** Except when conducting burnishing procedures, decelerations must be conducted in a direction such that the component of wind velocity opposite to the direction of travel of the vehicle does not exceed 15 km/h.

**31.4.7** Where a test requires that the gear selector is in "drive" the transmission selector control must be in the control position other than "overdrive" as recommended by the *'Manufacturer'* appropriate to the speed of the vehicle at the commencement of the deceleration mode, except that where the vehicle is equipped with a manually operated gear box the transmission may be disconnected from the engine output when the vehicle speed is less than 35 km/h.

**31.4.8** If the vehicle is not capable of attaining the initial vehicle speed requirement specified for a particular deceleration test, then, unless otherwise specified, the

initial vehicle speed must be a speed within 15 km/h of the *'Maximum Vehicle Speed 31/00'*.

**31.4.9** For all effectiveness and partial failure tests no part of the vehicle must move outside a straight lane 3.7 metres in width, the vehicle being positioned at the centre of the lane at the commencement of the deceleration.

**31.4.10** Except in the case of the parking brake test, the water recovery procedure and the water recovery test, each test procedure may be preceded by a series of 10 stops from not more than 65 km/h with a sustained deceleration not exceeding 3.5 m/s<sup>2</sup>.

**31.4.11** Unless otherwise specified *'Pedal Effort 31/00'* for any deceleration mode must not exceed 670 N.

**31.4.12** Automatic brake adjusters, if fitted, may be rendered inoperative prior to the commencement of the First Burnishing Procedure specified in clause 31.5.3. In cases where this option is exercised, adjusters must remain inoperative for the duration of the test program.

**31.4.13** Testing may be carried out with thermocouples inserted into brake linings and brake pads. The preferred size, type and method of installation of thermocouples are as specified in the U.S. Federal Motor Vehicle Safety Standard No. 105-75 or 105-JULY 19, 1976 "Hydraulic Brake Systems".

#### **31.5 PARTICULAR TEST CONDITIONS**

**31.5.1 Pre-test Instrumentation Check:** The number of decelerations for the purpose of instrumentation checks must not exceed 20. Such decelerations must be conducted from a speed of not more than 65 km/h and the actual deceleration must not exceed 3.5 m/s<sup>2</sup>.

**31.5.2 First Effectiveness Test:** The vehicle must be deemed to pass if all the parameters for each set of conditions specified in clause 31.3.1 are met on at least one deceleration mode within a number of deceleration modes which must not exceed 6.

**31.5.3 First Burnishing Procedure:** This must be conducted by making not more than 200 decelerations under the conditions specified in clause 31.3.1 such that any instantaneous deceleration must not exceed 5 m/s<sup>2</sup>.

The interval from the start of one service brake application to the start of the next must be not more than 1.6 km. The vehicle must be accelerated to the specified speed after each deceleration mode and maintained at that speed until initiating the next deceleration mode.

**31.5.3.1** On completion of the First Burnishing Procedure, the brake system may be adjusted in accordance with the *'Manufacturer's'* recommendation.

**31.5.4 Second Effectiveness Test:** If the *'Maximum Vehicle Speed 31/00'* is less than 135 km/h, the vehicle must be deemed to pass the test if all of the first 2 sets of conditions specified in clause 31.3.1 for this test are met on at least one deceleration mode within a number of deceleration modes which must not exceed 6. If the *'Maximum Vehicle Speed 31/00'* is not less than 135 km/h, the vehicle must be deemed to pass this test if all the parameters specified in clause 31.3.1 are met on at least one deceleration mode within a number of deceleration modes which must not exceed 6 in the case of each of the first 2 sets of parameters and 4 in the case of the third set of parameters.



**31.5.5 First Reburnishing Procedure:** The First Burnishing Procedure of clause 31.5.3 must be repeated except that the maximum number of deceleration modes must be 35.

**31.5.6 Parking Brake System Test:** Vehicles fitted with parking brake systems as described in clause 31.2.2.1.1 must meet the requirements of clause 31.5.6.1. Vehicles fitted with parking brake systems as described in clause 31.2.2.1.2 must meet the requirements of either clause 31.5.6.1 or clause 31.5.6.2.

**31.5.6.1** The vehicle must be positioned on a gradient of at least 30 per cent where the vertical rise is expressed as a percentage of the horizontal distance travelled to achieve this rise, such that the longitudinal axis of the vehicle is parallel to the direction of the gradient. The '*Parking Mechanism 31/00*' (if applicable) must be disengaged. The service brake must be applied, transmission disengaged and parking brake must be applied by a single application of the force specified except that a series of applications to achieve the specified force may be made in the case of a parking brake design that does not allow the application of the specified force in a single application. The service brake must be released for a period of not less than 5 minutes.

The vehicle must then be parked in the reverse position on the grade for a period of not less than 5 minutes. These conditions must be met under both conditions of loading specified. The force for actuation of a hand-operated parking brake system must be not greater than 400 N and must be applied at the centre of the hand grip area or not closer than 35 mm to the free end of the actuation lever. The force for actuation of a foot-operated parking brake system must be not greater than 540 N.

**31.5.6.1.1** The vehicle must be deemed to pass this test if, for each of the 5 minute periods, it remains stationary on the gradient or in the case where the test is carried out on a clean, dry, smooth portland cement concrete surface, there is no rotation of the wheels to which the parking brake is applied. If the vehicle does not remain stationary, re-application of the service brake to hold the vehicle stationary, with reapplication of the specified force to the parking brake control (without release of the ratcheting or other holding mechanism of the parking brake) may be used twice to attain a stationary position.

In cases where the parking brake system does not utilise the service brake '*Friction Elements*', the '*Friction Elements*' of the system may be burnished to the '*Manufacturer's*' recommendation prior to the test.

**31.5.6.2** The vehicle must be tested according to the test requirements specified in clause 31.5.6.1 except that both the parking brake and the '*Parking Mechanism 31/00*' must be engaged. Furthermore the vehicle must be capable of meeting the same requirements with the '*Parking Mechanism 31/00*' disengaged except that in this case the gradient must be not less than 20 per cent.

**31.5.7 Third Effectiveness Test:** The vehicle must be deemed to pass if all the parameters specified for each set of conditions specified in clause 31.3.1 are met on at least one deceleration mode within a number of deceleration modes which must not exceed 6.

**31.5.7.1 Minimum Pedal Effort Test:** In the case

where the requirements of clause 31.5.7 are achieved with a '*Pedal Effort 31/00*' of less than 150 N the sustained deceleration resulting when a '*Pedal Effort 31/00*' of not less than 65 N is applied from an initial vehicle speed of 45 km/h must not exceed  $5.45 \text{ m/s}^2$ .

**31.5.8 Partial Failure:** The vehicle must meet the requirements of clause 31.5.8.1 if fitted with a '*Split Service Brake System*' of clauses 31.5.8.2 and 31.5.8.3 if not fitted with a '*Split Service Brake System*'.

**31.5.8.1** In the case of a vehicle having a '*Split Service Brake System*' the vehicle must be deemed to satisfy the requirements of this clause if all the parameters specified in clause 31.3.1 are met by operation of the service brake control on at least one deceleration mode within a number of deceleration modes which must not exceed 4 for each single type of potential failure, including:

**31.5.8.1.1** failure of each sub-system of the split system;

**31.5.8.1.2** inoperative '*Antilock System*'; and

**31.5.8.1.3** inoperative '*Variable Proportioning Brake System*'.

**31.5.8.1.4** One single failure must be induced prior to each set of deceleration modes and the vehicle restored at the completion of the set.

**31.5.8.2** In the case of a vehicle not having a '*Split Service Brake System*' the vehicle must be deemed to satisfy the requirements of this clause if all the parameters specified in clause 31.3.1 are met by operation of the service brake control on each of 10 consecutive stops for each single type of potential failure, including:

**31.5.8.2.1** rupture or leakage of any component of the brake system other than a structural failure of a housing that is common to two or more sub-systems;

**31.5.8.2.2** inoperative '*Antilock System*';

**31.5.8.2.3** inoperative '*Variable Proportioning Brake System*'.

**31.5.8.2.4** One single failure must be induced prior to each set of deceleration modes and the vehicle restored at the completion of the set.

**31.5.8.3** In the case of a vehicle not having a '*Split Service Brake System*' but having a service brake system using '*Stored Energy*' the pressure and volume of the working fluid in the brake system (including any energy storage devices) must not exceed the minimum levels specified by the vehicle '*Manufacturer*' or achievable by adjustment of controls accessible to the driver for initiation of the failure mode prior to the commencement of any partial failure test sequence.

**31.5.9 Inoperative '*Brake Power Assist Unit*' or '*Brake Power Unit 31/00*':** The vehicle must meet the requirements of clause 31.5.9.1 or alternatively 31.5.9.2 if fitted with one or more '*Brake Power Assist Units*', or clause 31.5.9.3 if fitted with one or more '*Brake Power Units 31/00*'.

**31.5.9.1** The vehicle must be deemed to satisfy the requirements of this clause if under the parameters specified in clause 31.3.1 for this test a minimum '*Average Deceleration*' of  $2.55 \text{ m/s}^2$  is attained for one deceleration mode within a number of deceleration modes which must not exceed 4 when any one '*Brake Power Assist Unit*' or '*Brake Power Unit 31/00*' is inoperative and depleted of all reserve capability. One single failure

must be induced prior to each set of deceleration modes and the vehicle restored at the completion of the set.

**31.5.9.2** The vehicle must be deemed to satisfy the requirements of this clause if under the parameters specified in clause 31.3.1 for this test and with any one 'Brake Power Assist Unit' inoperative the following 'Average Decelerations' are attained on the first 6 consecutive stops with the inoperative unit not initially depleted of reserve capability, and the 'Average Deceleration' specified for the final seventh stop is attained with the inoperative unit depleted of reserve capability.

Stop number	Average deceleration in $m/s^2$
1	4.85
2	3.65
3	3.00
4	2.70
5	2.40
6	2.25
7	2.00

**31.5.9.3** In the case of a vehicle fitted with a 'Brake Power Unit 31/00' incorporating an accumulator-type reserve system, the vehicle must be deemed to satisfy the requirements of this clause if under the parameters specified in clause 31.3.1 for this test and with any one 'Brake Power Unit 31/00' inoperative the following 'Average Decelerations' are attained on the first 10 consecutive stops with the inoperative unit not initially depleted of reserve capability, and the 'Average Deceleration' specified for the final eleventh stop is attained with the inoperative unit depleted of reserve capability.

Stop Number	Average Deceleration in $m/s^2$
1	4.85
2	3.95
3	3.65
4	3.35
5	3.00
6	2.85
7	2.70
8	2.55
9	2.40
10	2.25
11	2.10

**31.5.9.4** In the case of a vehicle fitted with a 'Brake Power Unit 31/00' incorporating a backup type system, the vehicle must be deemed to satisfy the requirements of this clause if under the parameters specified in clause 31.3.1 for this test and with any one 'Brake Power Unit 31/00' inoperative the 'Average Deceleration' for each of 15 consecutive stops is not less than  $3.65 m/s^2$ .

**31.5.10 First Base Line Check Procedure:** Under the conditions specified in clause 31.3.1, 3 stops must be made such that the sustained deceleration of each stop is within  $\pm 0.2 m/s^2$  of the sustained deceleration of each of the other 2 stops and such that the sustained deceleration of all stops is  $3 \pm 0.5 m/s^2$ . The maximum force applied to the service brake 'Control' during each deceleration to 8 km/h must be recorded. The average of the maximum

force applied to the service brake 'Control' for the 3 deceleration modes must be calculated.

**31.5.10.1** The vehicle will be considered to have achieved a specific sustained deceleration if the specified deceleration was achieved within one second of commencing the stop and was maintained within the allowable tolerance until the vehicle speed is below 8 km/h.

**31.5.10.2** Measurements of sustained deceleration using a vehicle-mounted accelerometer which does not compensate for changes in vehicle attitude during deceleration are acceptable provided that the accelerometer is set to zero with the vehicle stationary on level ground and loaded to the 'Maximum Loaded Test Mass'.

**31.5.11 First Fade Test:** Ten deceleration modes must be conducted such that:

**31.5.11.1** the sustained deceleration of each of the first 5 modes is not less than  $4.50 m/s^2$ ; and

**31.5.11.2** for each of the remaining 5 modes, the sustained deceleration is either:

**31.5.11.2.1** not less than  $1.50 m/s^2$  and is the sustained deceleration achieved with application of a 'Pedal Effort 31/00' not less than 570 N nor more than the maximum allowable 'Pedal Effort 31/00'; or

**31.5.11.2.2** not less than  $4.50 m/s^2$ ; and

**31.5.11.3** the average time required to achieve the sustained deceleration must be not more than one second.

The control force requirements must be applicable whilst the vehicle speed is greater than 8 km/h. The vehicle must be subjected to maximum acceleration immediately after each stop and the distance between successive brake applications must be not more than 650 metres. In any case when the specified speed cannot be attained, decelerations must be conducted at the speed attained under maximum acceleration from the previous stop to a point not less than 620 metres from the commencement of the previous stop. The vehicle must be deemed to pass if the required deceleration can be achieved on all stops within the conditions specified.

**31.5.12 First Fade Recovery Procedure:** Immediately upon completion of the First Fade Test, the vehicle must be driven at  $50 \pm 5$  km/h for not more than 1.6 km.

Immediately after the 1.6 km conditioning, 4 stops must be effected at a sustained deceleration of  $3 \pm 0.5 m/s^2$  under the conditions specified. The distance between successive brake applications must be not more than 1.6 km.

**31.5.13 First Fade Recovery Test:** Immediately upon completion of the First Fade Recovery Procedure, the vehicle must be accelerated to the specified speed and within 1.6 km from the start of the test the vehicle must be decelerated in the same manner as for the First Base Line Check Procedure (clause 31.5.10) such that the sustained deceleration is within  $\pm 0.2 m/s^2$  of the arithmetic mean of the actual sustained decelerations recorded for the 3 deceleration modes of the First Base Line Check Procedure. The vehicle must be deemed to pass this test if the maximum force applied to the service brake control during the deceleration to 8 km/h is within + 90 N and either - 50 N or - 40 per cent, whichever gives the wider

range, of the average 'Control' force determined for the First Base Line Check Procedure (clause 31.5.10).

**31.5.14 Second Reburnishing Procedure:** This must be a repeat of the First Reburnishing Procedure (clause 31.5.5).

**31.5.15 Second Base Line Check Procedure:** This must be a repeat of the First Base Line Check Procedure (clause 31.5.10).

**31.5.16 Second Fade Test:** This must be a repeat of the First Fade Test (clause 31.5.11) except that 15 deceleration modes must be conducted such that:

**31.5.16.1** the sustained deceleration of each of the first 10 modes is not less than  $4.50 \text{ m/s}^2$ ; and

**31.5.16.2** for each of the remaining 5 modes, the sustained deceleration is either:

**31.5.16.2.1** not less than  $1.50 \text{ m/s}^2$  and is the sustained deceleration achieved with application of a 'Pedal Effort 31/00' not less than 570 N nor more than the maximum allowable 'Pedal Effort 31/00'; or

**31.5.16.2.2** not less than  $4.50 \text{ m/s}^2$ .

**31.5.17 Second Fade Recovery Procedure:** This must be a repeat of the First Fade Recovery Procedure (clause 31.5.12) except that it must be appropriate to the Second Fade Test.

**31.5.18 Second Fade Recovery Test:** This must be a repeat of the First Fade Recovery Test (clause 31.5.13) except that it must be appropriate to the Second Fade Recovery Procedure and the Second Base Line Check Procedure.

**31.5.19 Third Reburnishing Procedure:** This must be a repeat of the First Reburnishing Procedure (clause 31.5.5).

**31.5.20 Fourth Effectiveness Test:** The vehicle must be deemed to pass this test:

**31.5.20.1** if all of the parameters for each of the first 2 sets of conditions specified in clause 31.3.1 for this test are met on at least one deceleration mode within a number of deceleration modes which must not exceed 6; and

**31.5.20.2** if all of the parameters for the third set of conditions specified in clause 31.3.1 for this test are met on at least one deceleration mode within a number of deceleration modes which must not exceed 4 in the case where the 'Maximum Vehicle Speed 31/00' is greater than or equal to 135 km/h but less than 160 km/h; or

**31.5.20.3** if all the parameters for the fourth set of conditions specified in clause 31.3.1 for this test are met

on at least one deceleration mode within a number of deceleration modes which must not exceed 4 in the case where the 'Maximum Vehicle Speed 31/00' is not less than 160 km/h.

**31.5.21 Third Base Line Check Procedure:** This must be a repeat of the First Base Line Check Procedure (clause 31.5.10).

**31.5.22 Water Conditioning Procedure:** The vehicle must be driven with the brakes released through water of depth not less than 150 mm for a period of 2 minutes. During such period the vehicle speed must not exceed 10 km/h and for at least one minute must be not less than 5 km/h. For the purpose of this clause changes from drive to reverse and reverse to drive must be considered as continuous driving.

**31.5.23 Water Recovery Procedure:** Immediately upon completion of the Water Conditioning Procedure the First Fade Recovery Procedure (clause 31.5.12) must be repeated with the additional requirement that the brakes must not be applied except for the deceleration specified.

**31.5.24 Water Recovery Test:** This must be a repeat of the First Fade Recovery Test (clause 31.5.13) except that it must be appropriate to the Water Recovery Procedure and the Third Base Line Check Procedure, and further the vehicle must be deemed to pass this test if the maximum force applied to the service brake control during the deceleration to 8 km/h is within + 200 N and either - 50 N or - 40 per cent, whichever gives the wider range, of the average 'Control' force determined for the Third Base Line Check Procedure, but in no case must it exceed 400 N.

**31.5.25 'Spike Stops 31/00'**

**31.5.25.1** Ten 'Spike Stops 31/00' must be conducted under the conditions specified. A 'Pedal Effort 31/00' of not less than 885 N must be achieved within 400 milliseconds of pedal application and must be maintained until the vehicle is stationary.

**31.5.26 Final Effectiveness Test:** The vehicle must be deemed to pass this test if all the parameters specified for each set of conditions listed in clause 31.3.1 are met on at least one deceleration mode within a number of deceleration modes which must not exceed 6.