42 Dynamic Braking: Effective from 2007/1/1

Refer to: R13 11-R6/C1, R13H 00-S2/C1, R78 02-S3

42.1 Effective date and Scope:

42.1.1 As for the category symbols L1 and L3, the new vehicle variants from 2007/1/1 and all vehicle variants from 2009/1/1, shall comply with this regulation.

42.1.2 As for the category symbols M1, N and O, the new vehicle variants from 2008/1/1 and all vehicle variants from 2010/1/1 except full trailers of O3 and O4, shall comply with this regulation.

42.1.3 As for the full trailers of category symbols O3 and O4, all vehicle variants from 2011/1/1 shall comply with this regulation.

42.1.4 As for the category symbols M2 and M3, the new vehicle variants from 2008/1/1 and all vehicle variants from 2009/1/1, shall comply with this regulation.

42.1.5 This regulation does not suitable for:

42.1.5.1 Vehicles with a design speed not exceeding 25km/hr.

42.1.5.2 Trailers which may not be coupled to power-driven vehicles with a design speed exceeding 25 km/h.

42.1.6 The same applicant applying for low volume safety approval and the amounts of vehicle not exceed 3 at same year and small passenger vehicle of same type and specification, could exempt from regulation of “dynamic braking”.

42.1.7 The same applicant applying for vehicle-by-vehicle low volume safety approval and the amounts of vehicle not exceed 20 at same year and small passenger vehicle of same type and specification, could exempt from regulation of “dynamic braking”.

42.1.8 As for the category symbols M1 or N1, the same applicant applying for low volume safety approval and the amounts of vehicle not exceed 20 at same year and with same type and specification; or as for the category symbols N2, N3 or class III, class IV large passenger vehicles, the imported by governments, schools for self-use only, could be exempt from the requirement of secondary braking system performance and reserve(s) of energy device test.

42.2 Definitions

42.2.1 Transmission: means the combination of components comprised between the control system and the brake and linking them functionally. The transmission may be mechanical, hydraulic, pneumatic, electrical or mixed. Where the braking power is derived from or assisted by a source of energy independent of the driver, the reserve of energy in the system is likewise part of the transmission. The transmission is divided into 2 independent functions: the control transmission and the energy transmission. Whenever the term “transmission” is used alone in this regulation, it means both the “control transmission” and the “energy transmission.

42.2.2 Control Transmission: means the combination of the components of the transmission which control the operation of the brakes (including the control function and the necessary reserve(s) of energy).

42.2.3 Energy Transmission: means the combination of the components which supply to the brakes the necessary energy for their function (including the reserve(s) of energy necessary for the operation of the brakes).

42.2.4 Automatic Braking: means braking of the trailer or trailers occurring automatically in the event of separation of components of the combination of coupled vehicles, including such separation through the breakage of a coupling, the effectiveness of the braking of the remainder of the combination not being thereby destroyed.

42.2.5 Endurance Braking System: means an additional braking system having the capability to provide and to maintain a braking effect over a long period of time without a significant reduction in performance.

42.2.6 Electric Regenerative Braking: means a braking system which, during deceleration, provides for the conversion of vehicle kinetic energy into electrical energy.

42.2.6.1 Electric regenerative braking system of category A: means an electric regenerative braking system which is not part of the service braking system.

42.2.6.2 Electric regenerative braking system of category B: means an electric regenerative braking system which is part of the service braking system.

42.2.7 Automatically Commanded Braking: means a function within a complex electronic control system where actuation of the braking system(s) or brakes of certain axles is made for the purpose of generating vehicle retardation with or without a direct action of the driver, resulting from the automatic evaluation of on-board initiated information.

42.2.8 Selective Braking: means a function within a complex electronic control system where actuation of individual brakes is made by automatic means in which vehicle retardation is secondary to vehicle behavior modification.

42.3 Dynamic Braking shall according to suitable variants and range of principle are as below：

42.3.1 The same vehicle category symbol.

42.3.2 The same axle set variant.

42.3.3 The same brand and vehicle type.

42.3.4 The chassis vehicle have had same axle set variant.

42.3.5 The same chassis brand.

42.3.6 Chassis manufacturers announced that the same chassis vehicle type.

42.3.7 If use chassis vehicle instead of completed vehicle for entire or partial testing, which shall according to suitable variants and range of principle are as below：

42.3.7.1 The chassis vehicle have had same axle set variant.

42.3.7.2 The same brand.

42.3.7.3 Chassis manufacturers announced that the same chassis vehicle type.

42.3.8 If use combined braking （including entirely unit of system (also including electronic control system / modulation unit / wheel speed sensor of anti-lock system), layer structure, dimension, axis and tyre allocated installation ）of trailer instead of completed vehicle for entire or partial testing, which shall according to suitable variants and range of principle are as below：

42.3.8.1 The same vehicle category symbol.

42.3.8.2 The combined braking have had same axle set variant.

42.3.8.3 The same combined braking brand.

42.3.8.4 The same combined braking type.

42.3.8.5 The same brand of anti-lock system control unit.

42.3.8.6 The same type of anti-lock system control unit.

42.4 Specifications:

42.4.1 The braking system must fulfill the following functions.

42.4.1.1 Service Braking system: The service braking system must make it possible to control the movement of the vehicle and to halt it safely, speedily and effectively, whatever its speed and load, on any up or down gradient. It must be possible to graduate this braking action. The driver must be able to achieve this braking action from his driving seat without removing

his hands from the steering control.

42.4.1.2 Secondary Braking System (optional for vehicles of category symbol L): The secondary braking system must make it possible to halt the vehicle within a reasonable distance in the event of failure of the service braking system. It must be possible to graduate this braking action. The driver must be able to obtain this braking action from his driving seat while keeping at least one hand (both hands for M1) on the steering control.

42.4.1.3 Parking Braking system: (optional for vehicles of category symbol L)

42.4.1.3.1 The parking braking system must make it possible to hold the vehicle stationary on an up or down gradient even in the absence of the driver, the working parts being then held in the locked position by a purely mechanical device. The driver must be able to achieve this braking action from his driving seat.

42.4.1.3.2 On every trailer which is required to be equipped with a service braking system, parking braking must be assured even when the trailer is separated from the towing vehicle. The parking braking device must be capable of being actuated by a person standing on the ground; however, in the case of a trailer used for the carriage of passengers, this brake must be capable of being actuated from inside the trailer.

42.4.1.3.3 If the operation of the parking braking system on the power-driven vehicle also operates a braking system on the trailer, then the following additional requirements shall be met:

42.4.1.3.3.1 When the power-driven vehicle is equipped according to paragraph 42.4.1.5.1 below, the actuation of the parking brake system of the power-driven vehicle shall actuate a braking system on the trailer via the pneumatic control line.

42.4.1.3.3.2 When the power-driven vehicle is equipped according to paragraph 42.4.1.5.2, the actuation of the parking brake system on the power-driven vehicle shall actuate a braking system on the trailer as prescribed in paragraph a. above. In addition, the actuation of the parking brake system may also actuate a braking system on the trailer via the electric control line..

42.4.1.3.3.3 When the power-driven vehicle is equipped according to paragraph 42.4.1.5.3, the actuation of the parking braking system on the power-driven vehicle shall actuate a braking system on the trailer via the electric control line. When the electrical energy for the braking equipment of the power-driven vehicle is switched off, the braking of the trailer shall be effected by evacuation of the supply line (in addition, the pneumatic control line may remain pressurised); the supply line may only remain evacuated until the electrical energy for the braking equipment of the power-driven vehicle is restored and simultaneously the braking of the trailer via the electric control line is restored.

42.4.1.4 The connection of the compressed-air braking system between power-driven vehicles and trailers shall be provided according to:

42.4.1.4.1 One pneumatic supply line and one pneumatic control line.

42.4.1.4.2 One pneumatic supply line, one pneumatic control line and one electric control line.

42.4.1.4.3 One pneumatic supply line and one electric control line; Until uniform technical standards have been agreed, which ensure compatibility and safety, connections between power-driven vehicles and trailers, shall not be permitted.

42.4.1.5 Shut-off devices which are not automatically actuated shall not be permitted. In the case of articulated vehicle combinations, the flexible hoses and cables shall be a part of the power-driven vehicle. In all other cases, the flexible

hoses and cables shall be a part of the trailer.

42.5 Dynamic Braking for vehicles of category symbol M1

42.5.1 General Specifications

42.5.1.1 The braking equipment shall be so designed, constructed and fitted as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation. In particular, the braking equipment shall be so designed, constructed and fitted as to be able to resist the corroding and ageing phenomena to which it is exposed.

42.5.1.2 The effectiveness of the braking equipment shall not be adversely affected by magnetic or electrical fields.

42.5.1.3 Brake linings shall not contain asbestos. It shall be possible to easily check this wear on service brake linings from the outside or underside of the vehicle utilizing only the tools or equipment normally supplied with the vehicle. Alternatively, acoustic or optical devices warning the driver at his driving position when lining replacement is necessary are acceptable.. The yellow warning signal may be used as the optical warning signal. Wear adjustment shall be automatic for the service brakes.

42.5.1.4 In the event of failure in any part of the transmission of a braking system, the feed to the part not affected by the failure must continue to be ensured if required for the purpose of halting the vehicle. Malfunctions of the electric control transmission shall not apply the brakes contrary to the driver's intentions.

42.5.1.5 The service braking system shall act on all wheels of the vehicle and shall distribute its action appropriately among axles. No apparent failure occurs after being braked repeatedly.

42.5.1.6 In hydraulic-transmission braking systems, the filling ports of the fluid reservoirs must be readily accessible; in addition, the receptacles containing the reserve fluid must be so designed and constructed that the level of the reserve fluid can be easily checked without the receptacles having to be opened. The type of fluid to be used in hydraulic transmission braking systems shall be identified by the symbol and the appropriate marking. The symbol and the marking must be affixed in a visible position in indelible form within obvious distance of the filling ports of the fluid reservoirs.

42.5.1.7 The control of the service braking system must be independent of the control of the parking braking system.

42.5.1.8 The parking braking system shall be so designed that it can be actuated when vehicle is in motion.

42.5.1.9 Optical brake failure and Defect warning signals:

42.5.1.9.1 The warning signal shall be visible, even by daylight; the satisfactory condition of the signals shall be easily verifiable by the driver from the driver's seat; the failure of a component of the warning devices shall not entail any loss of the braking system's performance.

42.5.1.9.2 The warning signal(s) shall remain displayed as long as the failure/defect persists and the ignition (start) switch is in the "on" (run) position; and the warning signal shall be constant (not flashing).

42.5.1.9.3 The below-mentioned failure of a part of a hydraulic transmission system shall be signalled to the driver by a device comprising a red tell-tale signal lighting up:

42.5.1.9.3.1 Before or upon application of a differential pressure of not more than 15.5 bar between the active and failed brake equipment; and when the fluid in the reservoir is below a certain level specified by the manufacturer is permitted.

42.5.1.9.3.2 Application of the parking brake must also be indicated to the driver.

42.5.1.9.3.3 indicating failures defined elsewhere in this Regulation within the vehicle braking equipment which preclude achievement of the prescribed service braking performance and/or which preclude the functioning of at least one of two independent service braking circuits.

42.5.1.9.4 When the barking electrical control system happening to below situations, it shall be indicated with the yellow warning signal:

42.5.1.9.4.1 A break in the wiring within the electric transmission, or a failure in the control of the parking braking system shall be signalled to the driver.

42.5.1.9.4.2 Compensation by the electric control transmission for deterioration or defect within the braking system.

42.5.1.9.4.3 Where applicable, a yellow warning signal indicating an electrically detected defect within the vehicle braking equipment, which is not indicated by the red warning signal.

42.5.1.9.5 A failure within the electric control transmission, that affects the function and performance of systems addressed in this Regulation, shall be indicated to the driver by the red or yellow warning signal.

42.5.1.10 Braking Tfor vehicles fitted with an electric regenerative braking system of category A , transient conditions as gear changes or accelerator control release must not affect the behaviour of the vehicle。

42.5.1.11 Where use is made of energy other than the muscular energy of the driver, there need not be more than one source of such energy (hydraulic pump, air compressor, etc.), but the means by which the device constituting that source is driven must be as safe as practicable.

42.5.1.11.1 In the event of failure in any part of the transmission of a braking system, the feed to the part not affected by the failure must continue to be ensured if required for the purpose of halting the vehicle with the degree of effectiveness prescribed for secondary braking.

42.5.1.11.2 Furthermore, storage devices located down-circuit of this device must be such that in the case of a failure in the energy supply after four full-stroke actuations of the service brake control, it is still possible to halt the vehicle at the fifth application, with the degree of effectiveness prescribed for secondary braking.

42.5.1.11.3 Vehicles equipped with a hydraulic braking system with stored energy which cannot meet the requirements of paragraph 42.5.1.11.1. of this Regulation shall be deemed to satisfy that paragraph if the following requirements are met: After any single transmission failure it shall still be possible after eight full-stroke actuations of the service brake control to achieve, at the ninth application, at least the performance prescribed for the secondary braking system.

42.5.1.11.4 Any vehicle fitted with a service brake actuated from an energy reservoir must, where the prescribed secondary braking performance cannot be obtained by means of this brake without the use of the stored energy, be provided with a warning device, giving an optical or acoustic signal when the stored energy, in any part of the system, falls to a value at which without re-charging of the reservoir and irrespective of the load conditions of the vehicle, it is possible to apply the service brake control a fifth time after our full-stroke actuations and obtain the prescribed secondary braking

performance (without faults in the service brake transmission device and with the brakes adjusted as closely as possible). This warning device must be directly and permanently connected to the circuit. When the engine is running under normal operating conditions and there are no faults in the braking system, as is the case in type approval tests, the warning device must give no signal except during the time required for charging the energy reservoir(s) after start-up of the engine.

42.5.2 test:

42.5.2.1 General:

42.5.2.1.1 The performance prescribed for braking systems is based on the stopping distance and/or the mean fully developed deceleration.

42.5.2.1.1.1 Stopping Distance: means the distance covered by the vehicle from the moment when the driver begins to actuate the control of the braking system until the moment when the vehicle stops.

42.5.2.1.1.2 Mean Fully Developed Deceleration (dm): the deceleration average with respect to distance over the interval V_b toV_e:

$$d_m = \frac{v_b^2 - v_e^2}{25.92(s_e - s_b)}$$

where:

V_0= initial vehicle speed (km/h); not less than 98% of the prescribed speed for the test in question

V_b= vehicle speed at 0.8 V_0 (km/h),

V_e= vehicle speed at 0.1 V_0 (km/h),

S_b= distance travelled between V_0 and V_b(m),

S_e= distance travelled between V_0 and V_e (m).

42.5.2.1.2 The tests must be performed when there is no wind liable to affect the results.

42.5.2.1.3 The road must have a surface affording good adhesion, unless specified otherwise in the relevant regulation.

42.5.2.1.4 The prescribed performance must be obtained without locking of the wheels at speeds exceeding 15km/h, without deviation of the vehicle from a 3.5m wide lane, without exceeding a yaw angle of 15 degrees and without abnormal vibrations.

42.5.2.1.5 However, systems or functions, which use the braking system as the means of achieving a higher level objective, must not be deactivated during type Approval Testing of the braking system.

42.5.2.2 Type-0 Test: ordinary performance test with cold brakes

42.5.2.2.1 General:

42.5.2.2.1.1 The vehicle must be tested under both laden and unladen conditions.

42.5.2.2.1.1.1 Laden: means a vehicle so laden as to attain its "maximum mass".

42.5.2.2.1.1.2 Unladen: means a vehicle with the testing instruments, a driver and a recording operator.

42.5.2.2.1.2 In the case of a vehicle equipped with an electric regenerative braking system:

42.5.2.2.1.2.1 Category A: Any separate electric regenerative braking control which is provided, shall not be used during the Type-0 tests.

42.5.2.2.1.2.2 Category B: The contribution of the electric regenerative braking system to the braking force generated, when the state of charge of the batteries is in one of the following conditions, shall not exceed that minimum level guaranteed by the system design:

6-1.4.2.2.1.2.2.1 at the maximum charge level recommended by the manufacturer, as listed in the vehicle specification.

6-1.4.2.2.1.2.2.2 at a level not less than 95% of the full charge level, where the manufacturer has made no specific recommendation.

6-1.4.2.2.1.2.2.3 at a maximum level resulting from automatic charge control on the vehicle.

42.5.2.2.1.3 The limits prescribed for minimum performance, both for tests with the vehicle unladen and for tests with the vehicle laden, shall be those laid down hereunder; the vehicle must satisfy both the prescribed stopping distance and the prescribed mean fully developed deceleration.

42.5.2.2.1.4 The road must be level; unless otherwise specified each test may comprise up to six stops including any needed for familiarization.

42.5.2.2.2 Type-0 Test with engine disconnected (Neutral Gear) is carried out at the speed of 100 km/h. The minimum performance must be attained.

42.5.2.2.3 Type-0 Test with engine connected (Driving Gear) is carried out at the speed of 80% Vmax declared by the manufacturer but not greater than 160km/hr. The minimum performance must be attained. This test is not run if the maximum speed of the vehicle is □125km/h.

42.5.2.3 Type-I Test: Fade and Recovery Test

42.5.2.3.1 Heating procedure

42.5.2.3.1.1 The service brakes of all vehicles must be tested by successively applying and releasing the brakes a number of times, the vehicle being laden, in the conditions as below:

42.5.2.3.1.1.1 The initial speed (V1) is 80% Vmax, but □ 120 km/hr.

42.5.2.3.1.1.2 The speed at end of braking is 0.5V1.

42.5.2.3.1.1.3 The duration of a braking cycle is 45 seconds.

42.5.2.3.1.1.4 The number of brake application is 15.

42.5.2.3.1.2 in any event, in addition to the time necessary for braking and accelerating the vehicle, a period of 10 seconds must be allowed in each cycle for stabilizing the speed V1.

42.5.2.3.1.3 In these tests, the force applied to the control must be so adjusted as to attain a mean deceleration of 3 m/s2 during every brake application.

42.5.2.3.1.4 For the vehicles equipped with an electric regenerative braking system of category B, the condition of the vehicle batteries at the start of the test, as mentioned in paragraph 42.5.2.2.1.2.2, shall be such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design.

42.5.2.3.2 Hot Performance: At the end of the Type-I test, the hot performance of the service braking system must be measured in the same conditions as for the Type-0 test (with the engine disconnected, Neutral Gear) and in particular at a mean control force no greater than the mean force actually used (the temperature conditions may be different).

42.5.2.3.3 Recovery Procedure: Immediately after the hot performance test, make 4 stops from 50 km/h with the engine connected, at a mean deceleration of 3 m/s^2. Allow an interval of 1.5 km between the start of successive stops. Immediately after each stop, accelerate at maximum rate to 50 km/h and maintain that speed until making the next stop. At the end of the recovery procedure, the recovery performance of the service braking system must be measured in the same conditions as for the Type-0 test with the engine disconnected (the temperature conditions may be different), using a mean force on the control, which is not more than the mean control force used in the corresponding Type-0 test. Vehicles equipped with an electrical regenerative braking system of category B, may have their batteries recharged or replaced by a charged set, in order to complete the recovery procedure.

42.5.2.4 Test for Secondary Braking System:

42.5.2.4.1 The vehicle, under both laden and unladen conditions with the inactive auxiliary operation, inactive partial loop and damaged system components (assuming that not more than one failure or damage can occur at one time), the type-0 （Neutral Gear）test is carried out at the speed of 100 km/h.

42.5.2.4.2 The secondary braking effectiveness test shall be conducted by simulating the actual failure conditions in the service braking system.

42.5.2.4.3 For vehicle employing electric regenerative braking systems, the braking performance shall additionally be checked under the two following failure conditions:

42.5.2.4.3.1 For a total failure of the electric component of the service braking output.

42.5.2.4.3.2 In the case where the failure condition causes the electric component to deliver its maximum braking force.

42.5.2.5 Test for Parking Braking System:

42.5.2.5.1 The parking braking system must be, with the vehicle laden, tested on a 20 % up or down gradient.

42.5.2.5.2 On vehicles to which the coupling of a trailer is authorized, the parking braking system of the motor vehicle must be capable of holding the combination of vehicles stationary on a 12 per cent up or down gradient.

42.5.2.5.3 To check compliance with the requirement specified in paragraph42.5.1.8, a Type-0 test must be carried out, with the laden vehicle and the engine disconnected, at an initial test speed of 30 km/hr.

42.5.2.6 Response Time: Where a vehicle is equipped with a service braking system which is totally or partially dependent on a source of energy other than the muscular effort of the driver, it shall be exercised in an emergency manoeuver to measure the time elapsing between the moment when the control device begins to be actuated and the moment when the braking force on the least favorable placed axle reaches deceleration of the vehicle or the pressure at the least favorable brake cylinder of stipulation。

42.5.2.7 Energy Accumulators: Vehicles on which the braking equipment requires the use of stored energy provided by hydraulic fluid under pressure shall be equipped with energy storage devices (energy accumulators). However, the energy storage devices shall not be required to be of a prescribed capacity if the braking system is such that in the absence of any energy reserve it is possible with the service brake control to achieve a braking performance at least equal to that prescribed for the secondary braking system. It shall be conducted with following tests.

42.5.2.7.1 After eight full-stroke actuations of the service brake control, it shall still be conducted with the 9^{th} braking performance test.

42.5.2.7.1.1 Testing shall commence at a pressure that may be specified by the manufacturer but is not higher than the

cut-in pressure.

42.5.2.7.1.2 The energy storage device(s) shall not be fed; in addition, any energy storage device(s) for auxiliary equipment shall be isolated.

42.5.2.7.1.3 The rate of full-stroke actuations must be such as to provide an interval of at least 60 seconds between each actuation.

42.5.2.7.1.4 The engine is under idling speed.

42.5.2.7.2 Measure the time required for the pressure to rise from P_2 to P_1 in the energy storage device(s).

42.5.2.7.2.1 P_1 represents the maximum system operational pressure (cut-out pressure) in the energy storage device(s) specified by the manufacturer.

42.5.2.7.2.2 P_2 represents the pressure after four full-stroke actuations with the service brake control, starting at P_1, without having fed the energy storage device(s).

42.5.2.7.2.3 The engine is running at the speed corresponding to its maximum power or at the speed allowed by the over-speed governor.

42.5.2.7.2.4 Any energy storage device(s) for auxiliary equipment shall not be isolated other than automatically.

42.5.2.7.3 Characteristics of Warning Devices: With the engine stationary and commencing at a pressure that may be specified by the manufacturer but does not exceed the cut-in pressure, check whether the warning device operates following two full-stroke actuations of the service brake control.

42.5.2.8 Test for Distribution of Braking Force: Vehicles which are not equipped with a certified anti-lock system shall be conducted with the tests below:

42.5.2.8.1 The adhesion utilization curve

42.5.2.8.1.1 For all braking rates between 0.15 to 0.8, and all states of load of the vehicle, the manufacturer shall provide the adhesion utilization curves for the front and rear axles calculated by the formulae:

$$f_1 = \frac{T_1}{N_1} = \frac{T_1}{P_1 + z \cdot \frac{h}{E} \cdot P \cdot G}$$

$$f_2 = \frac{T_2}{N_2} = \frac{T_2}{P_2 - z \cdot \frac{h}{E} \cdot P \cdot G}$$

where, f_i = Adhesion utilized by axle i

T_i = Force exerted by the brakes on axle i under normal braking conditions on the road.

N_i = Normal reaction of road surface on axle i under braking

P_i = Normal reaction of road surface on axle i under static conditions

G = Acceleration due to gravity

z = Braking rate of vehicle

P = Mass of vehicle

h = height of centre of gravity specified by the manufacturer and agreed by the Technical Services conducting the approval test.

E = Wheelbase

42.5.2.8.1.2 The curves shall be plotted for the following load conditions:

42.5.2.8.1.2.1 unladen, in running order with the driver on board

42.5.2.8.1.2.2 laden; where provision, is made for several possibilities of load distribution, the one whereby the front axle is the most heavily laden shall be the one considered.

42.5.2.8.2 Verify conformity with the requirements contained in the present regulation by carrying out the wheel lock sequence test:

42.5.2.8.2.1 laden and unladen, engine disconnected.

42.5.2.8.2.2 Test Speed:

42.5.2.8.2.2.1 65 km/h for a braking rate □ 0.5.

42.5.2.8.2.2.2 100 km/h for a braking rate > 0.5.

42.5.2.8.2.3 Pedal Force:

42.5.2.8.2.3.1 Pedal force is increased at a linear rate such that the 1st axle lockup occurs no less than 0.5 second and no more than 1.5 seconds after the initial application of the pedal.

42.5.2.8.2.3.2 The pedal is released when the second axle locks, or when the pedal force reaches l kN, or 0.1 seconds after the first lockup, whichever occurs first.

42.5.2.8.2.4 This test is conducted on road test surfaces on which wheel lockup occurs at braking rates between 0.15 and 0.8; only wheel lockups above a vehicle speed of 15 km/h.

42.5.2.8.3 When the requirements are fulfilled by means of a special device (e.g. controlled mechanically by the suspension of the vehicle), it shall be possible, in the event of the failure of its control, (e.g. by disconnecting the control linkage), to stop the vehicle under the conditions of the Type-0 test with the engine disconnected.

42.5.3 Performance:

42.5.3.1 Service Braking System:

42.5.3.1.1 Type-0 Test (Neutral Gear): The mean fully developed deceleration □ 6.43 m/s2 with the stopping distance □ 70m ;the force applied to foot control shall be between 65 N and 500 N.

42.5.3.1.2 Typ-0 Test (Driving Gear): The mean fully developed deceleration □ 5.76 m/s2 with the stopping distance □ (0.1V+0.0067V2)m where V is the test speed. The force applied to foot control shall be between 65 N and 500 N.

42.5.3.1.3 In the case of M1 authorised to tow an unbraked trailer, the minimum Type-0 (Neutral Gear) performance of the combination shall not be less than 5.4 m/s^2 in both the laden and unladen conditions.

42.5.3.2 Secondary Braking System:

42.5.3.2.1 The stopping distance of foresaid 42.5.2.4.1 test must not exceed 168m with the mean fully developed deceleration

not less than 2.44 m/s2 and a force applied to the service brake control not less than 65 N and not exceeding 500 N.

42.5.3.2.2 In the event of the failure of the braking distribution system, it shall be possible to stop the vehicle under the conditions of the Type-0 test with the engine disconnected, at initial speed of 100 km/h, to give a stopping distance not exceeding 110m and a mean fully developed deceleration not less than 3.86 m/s^2.

42.5.3.3 Parking Braking System:

42.5.3.3.1 The parking braking system must be capable of holding the laden vehicle stationary on a 20 % up or down gradient.

42.5.3.3.2 On vehicles to which the coupling of a trailer is authorized, the parking braking system of the motor vehicle must be capable of holding the combination of vehicles stationary on a 12 % up or down gradient.

42.5.3.3.3 If the control device is manual, the force applied to it must not exceed 400 N; If it is a foot control device, the force exerted on the control must not exceed 500 N.

42.5.3.3.4 A parking braking system which has to be actuated several times before it attains the prescribed performance is admissible.

42.5.3.3.5 The mean fully developed deceleration of the test shall not be less than 1.5 m/s^2; the force exerted on the braking control device shall be between 65 N and 500 N.

42.5.3.4 Response Time: The time elapsing between the moment when the control device begins to be actuated and the moment when the braking force on the least favorable placed axle reaches the level corresponding to the prescribed performance must not exceed 0.6 seconds.

42.5.3.5 Hot Performance:

42.5.3.5.1 The hot performance must not be less than 75% of that prescribed in paragraph 42.5.3.1.1 (It corresponds to a stopping distance of (0.1V+0.0080V2) m and a mean fully developed deceleration of 4.82 m/s2.), nor less than 60% of the figure recorded in the Type-0 test with the engine disconnected.

42.5.3.5.2 In the case of a vehicle which satisfies the 60% requirement specified in paragraph above, but which cannot comply with the 75 % requirement of paragraph above, a further hot performance test may be carried out using a control force not exceeding that specified in paragraph 42.5.3.1.1. The results of both tests shall be entered in the report. The results of both tests shall be entered in the report.

42.5.3.6 Recover Performance: This recovery performance must not be less than 70%, nor more than 150%, of the figure recorded in the Type-0 test with the engine disconnected.

42.5.3.7 Energy Accumulator:

42.5.3.7.1 It shall still be possible to achieve, on the ninth application, the performance prescribed for the secondary braking system.

42.5.3.7.2 The time required for the pressure to rise from p2 to p1 in the energy storage device(s) shall not exceed 20 seconds.

42.5.3.7.3 The warning device shall not operate following two full-stroke actuations of the service brake control.

42.5.3.8 Braking Distribution Test:

42.5.3.8.1 Adhesion Utilization Curve:

42.5.3.8.1.1 For all states of load of the vehicle, the adhesion utilization curve of the rear axle shall not be situated above that for the front axle:

42.5.3.8.1.2 For the adhesion coefficient (k) between 0.2 and 0.8, the braking rate (z): $z \geq 0.1 + 0.7(k - 0.2)$

42.5.3.8.2 Wheel-Lock Sequence Test:

42.5.3.8.2.1 Both rear wheels shall not reach a locked condition prior to both front wheels being locked - at vehicle braking rates between 0.15 and 0.8. A simultaneous lockup of the front and rear wheels refers to the condition when the time interval between the lockup of the last (second) wheel on the rear axle and the last (second) wheel on the front axle is < 0.1 seconds for vehicle speeds > 30 km/hr.

42.5.3.8.2.2 If the wheel-lock sequence test indicates that the rear wheels lock before the front wheels, then the test should be repeated on a different road surface and/or be submitted to the torque wheel tests.

42.5.3.8.3 In the event of the failure of its control, (e.g. by disconnecting the control linkage), to stop the vehicle under the conditions of the Type-0 test with the engine disconnected to give a stopping distance not exceeding $(0.1V+0.0100V^2)$ m and a mean fully developed deceleration not less than 3.86 m/s^2.

42.5.4 In the event of a modification of vehicle type resulting from the fitting of brake linings, it is admissible for the exemption from the foresaid tests. But, it is supposed to submit the test data record of the original vehicle type and is conducted with the inertia dynamometer test in conformity with below regulations:

42.5.4.1 5 sets of new types shall be provided for testing. If the test data record of the original vehicle type is not submitted, a set of original type shall be also provided for testing.

42.5.4.2 It shall be tested with the temperature below 100℃. Brake applications shall be made from an initial rotational speed equivalent to that given in paragraph 42.5.2.2.2 of this Regulation, and the brake shall be applied to achieve a mean torque equivalent to the deceleration prescribed in that paragraph 42.5.2.2.2. In addition, tests shall also be carried out at several rotational speeds, the highest being equivalent to 80% of that speed and the lowest being equivalent to 30% of the maximum speed of the vehicle. The mean braking torque shall be within the test limits +/-15% of the mean braking torque recorded with the brake linings of the original type conforming to the component identified in the relevant application for vehicle type approval.

42.5.4.3 The mean braking torque recorded during the paragraph 42.5.2.3 above hot performance tests on the linings being tested for the purpose of comparison shall, for the same input measurement, be within the test limits +/- 15% of the mean braking torque recorded with the brake linings conforming to the component identified in the relevant application for vehicle type approval.

42.5.4.4 Brake linings shall be visually inspected on completion of the above tests to check that they are in satisfactory condition for continued use in normal service.

42.6 Dynamic Braking for vehicles of category symbols M2, M3, N and O.

42.6.1 General Specifications:

42.6.1.1 The braking equipment shall be so designed, constructed and fitted as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation. In particular, the braking equipment shall be so designed, constructed and fitted as to be able to resist the corroding and ageing phenomena to which it is exposed.

42.6.1.2 The effectiveness of the braking systems, including the electric control line, shall not be adversely affected by magnetic or electrical fields.

42.6.1.3 Brake linings shall not contain asbestos.

42.6.1.4 The control of the service braking system must be independent of the control of the parking braking system.

42.6.1.5 The service braking system and the parking braking system may use common components in their transmission(s), provided that in the event of a failure in any part of the transmission(s) the requirements for secondary braking are still ensured.

42.6.1.6 If the service braking system and the secondary braking system have the same control, the parking braking system must be so designed that it can be actuated when the vehicle is in motion.

42.6.1.7 Where the secondary braking system and the service braking system have a common control and a common transmission:

42.6.1.7.1 if service braking is ensured by the action of the driver's muscular energy assisted by one or more energy reserves, secondary braking must, in the event of failure of that assistance, be capable of being ensured by the driver's muscular energy assisted by the energy reserves, if any, which are unaffected by the failure.(the force applied to the service brake control not exceeding the prescribed maximum).

42.6.1.7.2 if the service braking force and transmission depend exclusively on the use, controlled by the driver, of an energy reserve, there must be at least two completely independent energy reserves, each provided with its own transmission, likewise independent; each of them may act on the brakes of only two or more wheels so selected as to be capable of ensuring by themselves the prescribed degree of secondary braking without endangering the stability of the vehicle during braking; in addition, each of the aforesaid energy reserves must be equipped with a warning device as defined in 42.6.1.16 below. In each service braking circuit in at least one of the air reservoirs a device for draining and exhausting is required in an adequate and easily accessible position.

42.6.1.8 Where there are separate controls for the service braking system and the secondary braking system, simultaneous actuation of the two controls must not render both the service braking system and the secondary braking system inoperative, either when both braking systems are in good working order or when one of them is faulty.

42.6.1.9 Certain parts, such as the pedal and its bearing, the master cylinder and its piston or pistons, the control valve, the linkage between the pedal and the master cylinder or the control valve (hydraulic/pneumatic system), the brake cylinders and their pistons (hydraulic/pneumatic system, and the lever-and-cam assemblies of brakes, shall not be regarded as liable to breakage; if they are amply dimensioned, are readily accessible for maintenance, and exhibit safety characteristics at least equal to those prescribed for other essential components (such as the steering linkage) of the vehicle. Any such part as aforesaid whose failure would make it impossible to brake the vehicle with a degree of effectiveness at least equal to that prescribed for secondary braking must be made of metal or of a material with equivalent characteristics and must not undergo notable distortion in normal operation of the braking systems.

42.6.1.10 The service braking system shall act on all wheels of the vehicle and shall distribute its action appropriately among the axles. After repeated operation, it shall not readily cause the notable disorder caused by braking system. In the case of vehicles with more than two axles, in order to avoid wheel-locking or glazing of the brake linings, the brake force on certain axles may be reduced to zero automatically when carrying a much reduced load, provided that the vehicle meets all the performance requirements prescribed in this Regulation.

42.6.1.11 The action of the service braking system shall be distributed between the wheels of one and the same axle symmetrically in relation to the longitudinal median plane of the vehicle. Compensation and functions, such as anti-lock, which may cause deviations from this symmetrical distribution, shall be declared.

42.6.1.12 Malfunctions of the electric control transmission shall not apply the brakes contrary to the driver's intentions.

42.6.1.13 Wear of the brakes must be capable of being easily taken up by means of a system of manual or automatic adjustment. In addition, the control and the components of the transmission and of the brakes must possess a reserve of travel and, if necessary, suitable means of compensation such that, when the brakes become heated, or the brake linings have reached a certain degree of wear, effective braking is ensured without immediate adjustment being necessary:

42.6.1.13.1 Wear adjustment shall be automatic for the service brakes. However, the fitting of automatic brake adjustment devices is optional for vehicles of categories O1 and O2, off road vehicles of categories N2 and N3 and for the rear brakes of vehicles of category N1.

42.6.1.13.2 Checking the wear of the service brake friction components：

42.6.1.13.2.1 It shall be possible to easily check this wear on service brake linings from the outside or underside of the vehicle utilizing only the tools or equipment normally supplied with the vehicle, for instance by the provision of appropriate inspection holes or by some other means. Alternatively, acoustic or optical devices warning the driver at his driving position when lining replacement is necessary are acceptable. The removal of front/rear wheels is permitted for this purpose on categories M1 and N1 vehicles only. The yellow warning signal specified in paragraph 42.6.1.16 may be used as the optical warning signal.

42.6.1.13.2.2 Assessment of the wear condition of the friction surfaces of brake discs or drums may only be performed by direct measurement of the actual components, which may necessitate some level of disassembly. Therefore, at the time of type approval, the vehicle manufacturer shall define the following:

42.6.1.13.2.2.1 The method by which wear of the friction surfaces of drums and discs may be assessed, including the level of disassembly required and tools and process required to achieve this.

42.6.1.13.2.2.2 Information defining the maximum acceptable wear limit at the point at which replacement becomes necessary.

42.6.1.14 In hydraulic-transmission braking systems, the filling ports of the fluid reservoirs must be readily accessible; in addition, the receptacles containing the reserve fluid must be so designed and constructed that the level of the reserve fluid can be easily checked.

42.6.1.15 Coupling Force Control：

42.6.1.15.1 Coupling force control shall only be permitted in the towing vehicle. The action of the coupling force control shall be to reduce the difference between the dynamic braking rates of towing and towed vehicles.

42.6.1.15.2 A coupling force control system shall control only the coupling forces generated by the service braking system of the motor vehicle and the trailer, excluding endurance braking systems.

42.6.1.16 Warning Signal:

42.6.1.16.1 The warning signals shall be visible, even by daylight; the satisfactory condition of the signals shall be easily verifiable by the driver from the driver's seat; the failure of a component of the warning devices shall not entail any loss of the braking system's performance.

42.6.1.16.2 The warning signal(s) shall remain displayed as long as the failure/defect persists and the ignition (start) switch is in the "on" (run) position; and the warning signal shall be constant (not flashing).

42.6.1.16.3 The below-mentioned failure of a part of a hydraulic transmission system shall be signalled to the driver by a device

comprising a red tell-tale signal lighting up:

42.6.1.16.3.1 The failure of a part of a hydraulic transmission system shall be signalled to the driver by a device comprising a red warning signal. Alternatively, the lighting up of this device when the fluid in the reservoir is below a certain level specified by the manufacturer shall be permitted.

42.6.1.16.3.2 Actuation of the parking brake.

42.6.1.16.3.3 When the supply voltage to the trailer falls below a value nominated by the manufacturer at which the prescribed service braking performance can no longer be guaranteed, the separate yellow warning signal specified in paragraph 5.2.1.29.2. shall be activated via pin 5 of the ISO 7638:1997 */ connector. In addition, trailers equipped with an electrical control line, when electrically connected to a towing vehicle with an electric control line, shall provide the failure information for actuation of the red warning signal specified in paragraph 5.2.1.29.2.1. via the data communication part of the electric control line.

42.6.1.16.4 When the barking electrical control system happening to below situations, it shall be indicated with the yellow warning signal:

42.6.1.16.4.1 A break in the wiring within the electric transmission, or a failure in the control of the parking braking system shall be signalled to the driver.

42.6.1.16.4.2 Compensation by the electric control transmission for deterioration or defect within the braking system.

42.6.1.16.4.3 Where applicable, a yellow warning signal indicating an electrically detected defect within the vehicle braking equipment, which is not indicated by the red warning signal.

42.6.1.16.4.4 A coupling force control failure.

42.6.1.16.4.5 With the exception of vehicles of categories M1 and N1, power-driven vehicles equipped with an electric control line and/or authorised to tow a trailer equipped with an electric control transmission and/or anti-lock braking system, a defect within the anti-lock braking system and/or electric control transmission of the braking equipment of the trailer.

42.6.1.16.4.6 Trailers that utilize selective braking as a means to enhance vehicle stability, in the event of a failure within the electric control transmission of the stability system.

42.6.1.16.4.7 When the supply voltage to the trailer falls below a value nominated by the manufacturer at which the prescribed service braking performance can no longer be guaranteed.

42.6.1.16.5 A failure within the electric control transmission, that affects the function and performance of systems addressed in this Regulation, shall be indicated to the driver by the red or yellow warning signal.

42.6.1.17 The braking System of Category O vehicle:

42.6.1.17.1 Trailers of category O1 need not be equipped with a service braking system; however, if a trailer of this category is equipped with a service braking system, it must satisfy the same requirements as a trailer of category O2.

42.6.1.17.2 Trailers of category O2 must be equipped with a service braking system either of the continuous or semi-continuous or of the inertia (overrun) type. The latter type shall be authorized only for trailers other than semi-trailers.

42.6.1.17.3 Trailers of categories O3 and O4 must be equipped with a service braking system of the continuous or semi-continuous type.

42.6.1.17.4 In the case of a power-driven vehicle to which the coupling of a trailer equipped with a brake controlled by the driver

of the towing vehicle is authorized, the service braking system of the towing vehicle must be equipped with a device so designed that in the event of failure of the trailer's braking system, or in the event of an interruption in the air supply pipe (or of such other type of connection as may be adopted) between the towing vehicle and its trailer, it shall still be possible to brake the towing vehicle with the effectiveness prescribed for secondary braking; it is accordingly prescribed, in particular, that this device shall be situated on the towing vehicle.

42.6.1.17.5 In the event of a failure (e.g. breakage of or leak) in one of the pneumatic connecting lines, interruption or defect in the electric control line, it shall nevertheless be possible for the driver fully or partially to actuate the brakes of the trailer by means either of the service braking control or of the secondary braking control or of the parking braking control, unless the failure automatically causes the trailer to be braked with the performance prescribed in paragraph 42.6.4.3.

42.6.1.18 Where use is made of energy other than the muscular energy of the driver, there need not be more than one source of such energy, but he means by which the device constituting that source is driven must be as safe as practicable.

42.6.1.18.1 Any vehicle fitted with a service brake actuated from an energy reservoir mustbe provided with a warning device, giving an optical or acoustic signal when the stored energy, in any part of the system, falls to a value at which without re-charging of the reservoir and irrespective of the load conditions of the vehicle, it is possible to apply the service brake control a fifth time after our full-stroke actuations and obtain the prescribed secondary braking performance (without faults in the service brake transmission device and with the brakes adjusted as closely as possible). This warning device must be directly and permanently connected to the circuit. When the engine is running under normal operating conditions and there are no faults in the braking system, as is the case in type approval tests, the warning device must give no signal except during the time required for charging the energy reservoir(s) after start-up of the engine.

42.6.1.19 Trailers of categories O3 and O4 shall satisfy the conditions if it installed automatic braking of the trailer shall comply with stipulations as below：

42.6.1.19.1 when the designated brake control of the controls, is fully actuated, the pressure in the supply line must fall to 150 kPa within the following two seconds; in addition, when the brake control is released, the supply line shall be re-pressurised.

42.6.1.19.2 when the supply line is evacuated at the rate of at least 100 kPa per second the automatic braking of the trailer must start to operate before the pressure in the supply line falls to 200 kPa.

42.6.1.20 Generation of a signal to illuminate stop lamps.

42.6.1.20.1 Activation of the service braking system by the driver shall generate a signal that will be used to illuminate the stop lamps.

42.6.1.20.2 Signal generation applicable to Endurance Braking systems: It is permitted to generate the signal in conjunction with the operation of an endurance braking system but except when the retardation is generated by the engine braking alone.

42.6.1.20.3 Activation of the service braking system by "automatically commanded braking" shall generate the signal. In the case of trailers equipped with an electric control line the message "illuminate stop lamps" shall be transmitted by the trailer via the electric control line when the trailer braking system is activated during "automatically commanded braking" initiated by the trailer. However, when the retardation generated is less than 0.7 m/s2 at a vehicle speed greater than 50 km/h the signal may be suppressed.

42.6.1.20.4 Activation of part of the service braking system by "selective braking" shall not generate the signal.
（During a "selective braking" event, the function may change to "automatically commanded braking".）

42.6.1.20.5 In the case of vehicles equipped with an electric control line the signal shall be generated by the motor vehicle when a message "illuminate stop lamps" is received via the electric control line from the trailer. In the case of trailers equipped with an electric control line the message "illuminate stop lamps" shall not be transmitted by the trailer via the electrical control line during "selective braking" initiated by the trailer.
（This requirement shall not apply until the ISO 11992 Standard has been amended to include a message "illuminate stop lamps" and introduced into this Regulation.）

42.6.1.20.6 When produce a retarding force from Electric regenerative braking systems upon release of the throttle pedal, shall not generate a signal.

42.6.2 Braking Test

42.6.2.1 General:

42.6.2.1.1 The performance of a braking system shall be determined by measuring the stopping distance in relation to the initial speed of the vehicle and/or by measuring the mean fully developed deceleration during the test.

42.6.2.1.1.1 Stopping Distance: means the distance covered by the vehicle from the moment when the driver begins to actuate the control of the braking system until the moment when the vehicle stops.

42.6.2.1.1.2 The mean fully developed deceleration (dm): shall be calculated as the deceleration averaged with respect to distance over the interval Vb to Ve, according to the following formula:

$$d_m = \frac{v_b^2 - v_e^2}{25.92(s_e - s_b)}$$

where:

v_0= initial vehicle speed (km/h); not less than 98% of the prescribed speed for the test in question.
v_b=vehicle speed at 0.8 v_0 (km／hr)
v_e= vehicle speed at 0.1 v_0 (km／hr)
s_b= distance traveled between v_0 and v_b (m)
s_e= distance traveled between v_0 and v_e (m)

42.6.2.1.2 the vehicle's condition as regards mass must be as prescribed for each type of test and be specified in the test report

42.6.2.1.3 The tests must be performed when there is no wind liable to affect the results; The road must have a surface affording good adhesion, unless specified otherwise in the relevant regulation.

42.6.2.1.4 If the maximum design speed of a vehicle is lower than the speed prescribed for a test, the test shall be performed at the vehicle's maximum speed.

42.6.2.1.5 The prescribed performance must be obtained without locking of the wheels (at speeds exceeding 15km/h), without deviation of the vehicle from its course, and without abnormal vibrations.

42.6.2.1.6 If systems or functions, which use the braking system as the means of achieving a higher level objective, are provided, they must not be deactivated during type approval testing of the braking system.

42.6.2.2 Type-0 Test: ordinary performance test with brakes cold

42.6.2.2.1 General:

42.6.2.2.1.1 The brakes must be cold; a brake is deemed to be cold when the temperature measured on the disc or on the outside of the drum is below 100℃) respectively on both laden and unladen conditions.

42.6.2.2.1.1.1 Laden: means a vehicle so laden as to attain its "maximum mass.

42.6.2.2.1.1.2 Unladen: means a vehicle with the testing instruments, a driver and a recording operator.

42.6.2.2.1.1.3 The distribution of its mass among the axles being that stated by the manufacturer; where provision is made for several arrangements of the load on the axles the distribution of the maximum mass among the axles must be such that the load on each axle is proportional to the maximum permissible load for each axle; In the case of tractors for semi-trailers, the load may be re-positioned approximately half-way between the kingpin position resulting from the above loading conditions and the centreline of the rear axle(s).

42.6.2.2.1.1.4 In the case of a tractor for a semi-trailer, the unladen tests will be conducted with the vehicle in its solo condition, including a mass representing the fifth wheel.

42.6.2.2.1.1.5 In the case of a vehicle presented as a bare chassis-cab, a supplementary load may be added to simulate the mass of the body, not exceeding the minimum mass declared by the manufacturer.

42.6.2.2.1.2 In the case of a vehicle equipped with an electric regenerative braking system:

42.6.2.2.1.2.1 Category A: Any separate electric regenerative braking control which is provided, shall not be used during the Type-0 tests.

42.6.2.2.1.2.2 Category B: The contribution of the electric regenerative braking system to the braking force generated, when the batteries are at one of the following state of charge conditions, shall not exceed that minimum level guaranteed by the system design:

6-1.5.2.2.1.2.2.1 at the maximum charge level as recommended by the manufacturer in the vehicle specification, or

6-1.5.2.2.1.2.2.2 at a level not less than 95% of the full charge level, where the manufacturer has made no specific recommendation, or

6-1.5.2.2.1.2.2.3 at the maximum level which results from automatic charge control on the vehicle.

42.6.2.2.2 Type-0 Test with engine disconnected (Neutral Gear) is conducted at the vehicle speed specified in table 1.

42.6.2.2.3 Type-0 Test with engine connected (Driving Gear) is conducted at the speed limitation specified in table 1.

42.6.2.2.3.1 Tests must also be carried out at various speeds, the lowest being equal to 30% of the maximum speed of the vehicle and the highest being equal to 80% of that speed.

42.6.2.2.3.2 In the case of vehicles equipped with a speed limiter, this limiter speed shall be taken as the maximum speed of the vehicle.

42.6.2.2.3.3 Tractors for semi-trailers, artificially loaded to simulate the effects of a laden semi-trailer shall not be tested beyond 80 km/h.

Table 1 Type-0 Test Vs. Category-Speed (km/hr)

	Category	M_2	M_3	N_1	N_2	N_3

	Type of test	0-I	0-I-II或IIA	0-I	0-I	0-I-II
Type-0 Test (Neutral Gear)	v	60	60	80	60	60
Type-0 Test, Engine Connected	v=0.80v_{max} but not exceeding	100	90	120	100	90

42.6.2.2.4 Type-0 test for vehicles of category O, equipped with compressed-air brakes:

42.6.2.2.4.1 The braking performance of the trailer can be calculated either from the braking rate of the towing vehicle plus the trailer and the measured thrust on the coupling or, in certain cases, from the braking rate of the towing vehicle plus the trailer with only the trailer being braked. The engine of the towing vehicle must be disconnected during the braking test.
In the case where only the trailer is braked, to take account of the extra mass being retarded, the performance will be taken to be the mean fully developed deceleration.

42.6.2.2.4.2 With the exception of cases according to paragraphs 42.6.2.2.4.3 and 42.6.2.2.4.4 below, it is necessary for the determination of the braking rate of the trailer to measure the braking rate of the towing vehicle plus the trailer and the thrust on the coupling. The braking rate of the trailer is calculated according to the following formula:

$$Z_R = Z_{R+M} + \frac{D}{P_R}$$

where:

Z_R = braking rate of trailer,

Z_{R+M} = braking rate of the towing vehicle plus the trailer,

D = thrust on the coupling,
(tractive force： +D)，
(compressive force： -D)

P_R = total normal static reaction between road surface and wheels of trailer.

42.6.2.2.4.3 If a trailer has a continuous or semi-continuous braking system where the pressure in the brake actuators does not change during braking despite the dynamic axle load shifting and in the case of semi-trailers the trailer alone may be braked. The braking rate of the trailer is calculated according to the following formula:

$$Z_R = (Z_{R+M} - R) \cdot \frac{P_M + P_R}{P_R} + R$$

where:

R =Rolling Resistance = 0.01

P_M = total normal static reaction between road surface and wheels of towing vehicles for trailers

42.6.2.2.4.4 Alternatively, the evaluation of the braking rate of the trailer may be done by braking the trailer alone. In this case the pressure used shall be the same as that measured in the brake actuators during the braking of the combination.

42.6.2.3 Type-I Test: Fade Test

42.6.2.3.1 In the case of vehicles equipped with automatic brake adjustment devices the adjustment of the brakes shall, prior to the Type-I test above, be set according to the following procedures as appropriate:

42.6.2.3.1.1 In the case of vehicles equipped with air operated brakes the adjustment of the brakes shall be such as to enable the automatic brake adjustment device to function.

42.6.2.3.1.2 In the case of vehicles equipped with hydraulically operated disc brakes no setting requirements are deemed necessary.

42.6.2.3.1.3 In the case of vehicles equipped with hydraulically operated drum brakes the adjustment of the brakes shall be as specified by the manufacturer.

42.6.2.3.2 Heating Procedure

42.6.2.3.2.1 The service brakes of all power-driven vehicles must be tested by successively applying and releasing the brakes a number of times, the vehicle being laden, in the conditions shown in the table below:

Category	Condition			
	v_1	v_2	Δt (秒)	n
M_2	80% v_{MAX} □100	1/2 v_1	55	15
N_1	80% v_{MAX} □120	1/2 v_1	55	15
M_3 ， N_2 ， N_3	80% v_{MAX} □60	1/2 v_1	60	20

where:

v_1 = initial speed, at beginning of braking (km/hr)
v2 = speed at end of braking (km/hr)
vMAX = maximum speed of vehicle (km/hr)
n = number of brake applications

Δt = duration of a braking cycle：time elapsing between the initiation of one brake application and the initiation of the next.

42.6.2.3.2.2 In any event, in addition to the time necessary for braking and accelerating the vehicle, a period of 10 seconds must be allowed in each cycle for stabilizing the speed v1.

42.6.2.3.2.3 In these tests, the force applied to the control must be so adjusted as to attain the mean fully developed

deceleration of 3 m/s2 at the first brake application; this force must remain constant throughout the succeeding brake applications.

42.6.2.3.2.4 During brake applications, the highest gear ratio (excluding overdrive, etc.) must be continuously engaged.

42.6.2.3.2.5 For vehicles equipped with an electric regenerative braking system of category B, the condition of the vehicle batteries at the start of the test, shall be at one of the state of charge conditions listed in paragraph 42.6.2.2.1.2.2 such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design.

42.6.2.3.3 Continuous Braking:

42.6.2.3.3.1 The service brakes of trailers of categories O2 and O3 must be tested in such a manner that, the vehicle being laden, the energy input to the brakes is equivalent to that recorded in the same period of time with a laden vehicle driven at a steady speed of 40 km/h on a 7% down-gradient for a distance of 1.7 km.

42.6.2.3.3.2 The test may be carried out on a level road, the trailer being drawn by a towing vehicle; during the test, the force applied to the control must be adjusted so as to keep the resistance of the trailer constant (7% of the maximum total stationary axle load of the trailer). If the power available for hauling is insufficient, the test can be conducted at a lower speed but over a greater distance as shown in the table below:

Speed (km/h)	Distance (m)
40	1700
30	1950
20	2500
15	3100

42.6.2.3.4 Hot Performance Test:

At the end of the Type-I test, the hot performance of the service braking system must be measured in the same conditions (and in particular at a constant control force no greater than the mean force actually used) as for the Type-0 test with the engine disconnected (the temperature conditions may be different).

42.6.2.3.5 Free Running Test:

In the case of motor vehicles equipped with automatic brake adjustment devices, the brakes after completing the tests defined in paragraph 42.6.2.3.4 above will be allowed to cool to a temperature representative of a cold brake and it shall be verified that the vehicle is capable of free running by fulfilling one of the following conditions:

42.6.2.3.5.1 Wheels are running freely (i.e. may be rotated by hand)

42.6.2.3.5.2 When the vehicle is driven at a constant speed of v = 60 km/h with the brakes released the asymptotic temperatures and the residual brake moments shall be checked.

42.6.2.4 Type-II Test (Downhill Behavior Test):

42.6.2.4.1 Laden power-driven vehicles must be tested in such a manner that the energy input is equivalent to that recorded in the same period of time with a laden vehicle driven at an average speed of 30 km/h on a 6% down-gradient for a distance of 6 km, with the appropriate gear engaged and the endurance braking system, if the vehicle is equipped with one, being used. The gear engaged must be such that the speed of the engine (min-1) does not exceed the maximum value prescribed by the manufacturer.

42.6.2.4.2 For vehicles in which the energy is absorbed by the braking action of the engine alone, a tolerance of +/- 5 km/h on the average speed shall be permitted, and the gear enabling the speed to be stabilized at the value closest to 30 km/h on the 6% down-gradient shall be engaged. If the performance of the braking action of the engine alone is determined by a measurement of deceleration, it shall be sufficient if the mean deceleration measured is at least 0.5 m/s2.

42.6.2.4.3 At the end of the test, the hot performance of the service braking system must be measured in the same conditions as for the Type-0 test with the engine disconnected (the temperature conditions may be different).

42.6.2.5 Type-III Test (Fade Test for Vehicles of Category O4)

42.6.2.5.1 Track Test

42.6.2.5.1.1 The adjustment of the brakes shall, prior to the Type-III test below, be set according to the following procedures as appropriate:

42.6.2.5.1.1.1 In the case of trailers equipped with air operated brakes the adjustment of the brakes shall be such as to enable the automatic brake adjustment device to function.

42.6.2.5.1.1.2 In the case of trailers equipped with hydraulically operated disc brakes no setting requirements are deemed necessary.

42.6.2.5.1.1.3 In the case of trailers equipped with hydraulically operated drum brakes the adjustment of the brakes shall be as specified by the manufacturer.

42.6.2.5.1.2 For the road test the conditions shall be as follows:

42.6.2.5.1.2.1 20 times of brake application with each braking cycle duration of 60 seconds.

42.6.2.5.1.2.2 The Initial speed at the beginning of braking is 60 km/h; In these tests, the force applied to the control must be so adjusted as to attain the mean fully developed deceleration of 3 m/s^2 in respect to the trailer mass (PR) at the first brake application; this force must remain constant throughout the succeeding brake applications.

42.6.2.5.1.3 The braking rate of a trailer is calculated according to the formula given in paragraph 42.6.2.2.4.3.

42.6.2.5.1.4 The speed at the end of braking:

$$v_2 = v_1 \cdot \sqrt{\frac{P_M + P_1 + P_2 / 4}{P_M + P_1 + P_2}}$$

where:

Z_R = braking rate of the trailer

Z_{R+M} = braking rate of the vehicle combination (motor vehicle and trailer)

R = Rolling Resistance = 0.01

P_M = total normal static reaction between the road surface and the wheels of towing vehicle for trailer (kg)

P_R = total normal static reaction between the road surface and the wheels of trailer (kg)

P_1 = part of the mass of the trailer borne by the unbraked axle(s) (kg)

P_2 = part of the mass of the trailer borne by the braked axle(s) (kg)

v_1 = initial speed (km/h)

v_2 = final speed (km/h)

42.6.2.5.2 Hot Performance Test:

At the end of the test according to paragraph 42.6.2.5.1, the hot performance of the service braking system must be measured under the same conditions as for the Type-0 test with, however, different temperature conditions and starting from an initial speed of 60 km/h.

42.6.2.5.3 Free Running Test:

After completing the tests defined in paragraph 42.6.2.5.2, above, the brakes will be allowed to cool to a temperature representative of a cold brake and it shall be verified that the trailer is capable of free running by fulfilling one of the following conditions:

42.6.2.5.3.1 Wheels are running freely (i.e. may be rotated by hand)

42.6.2.5.3.2 When the vehicle is driven at a constant speed of v = 60 km/h with the brakes released the asymptotic temperatures and the residual brake moments shall be checked.

42.6.2.6 Type-IIA Test (Endurance braking performance)

42.6.2.6.1 Vehicles of the following categories shall be subject to the Type-IIA test:

42.6.2.6.1.1 Interurban motor coach or long distance touring motor coach of categories M3.

42.6.2.6.1.2 Vehicles of category N3 which are authorized to tow a trailer of category O4

42.6.2.6.1.3 The power-driven vehicle and trailers with endurance braking system intended for use as transport units for dangerous goods（ADR）.

42.6.2.6.2 Test Conditions：

42.6.2.6.2.1 The performance of the endurance braking system shall be tested at the maximum mass of the vehicle or of the vehicle combination.

42.6.2.6.2.2 Testing in such a manner that the energy input is equivalent to that recorded in the same period of time with a laden vehicle driven at an average speed of 30 km/h on a 7% down-gradient for a distance of 6 km. During the test, the service, secondary and parking braking systems must not be engaged. The gear engaged must be such that the speed of the engine does not exceed the maximum value prescribed by the manufacturer. An integrated endurance braking system may be used, provided that it is suitably phased such that the service braking system is not applied; this may be verified by checking that its brakes remain cold.

42.6.2.6.2.3 For vehicles in which the energy is absorbed by the braking action of the engine alone, a tolerance of +/- 5 km/h on the average speed shall be permitted, and the gear enabling the speed to be stabilized at a value closest to 30 km/h on a 7% down-gradient shall be engaged.

42.6.2.7 Secondary Braking System :

42.6.2.7.1 The performance of the secondary braking system must be checked by the Type-0 test with engine disconnected from the following initial speeds:

	M2	M3	N1	N2	N3
Speed(km/h)	60	60	70	50	40

42.6.2.7.2 The secondary braking effectiveness test shall be conducted by simulating the actual failure conditions in the service braking system.

42.6.2.7.3 For vehicles employing electric regenerative braking systems, the braking performance shall additionally be checked under the two following failure conditions:

42.6.2.7.3.1 For a total failure of the electric component of the service braking output.

42.6.2.7.3.2 In the case where the failure condition causes the electric component to deliver its maximum braking force.

42.6.2.8 Test for Parking Braking System:

42.6.2.8.1 The parking braking system must, with the vehicle laden, be tested on an 18% up or down-gradient.

42.6.2.8.2 On vehicles to which the coupling of a trailer is authorized, the parking braking system of the towing vehicle must be, with the combination of vehicles, tested on a 12% up or down-gradient.

42.6.2.8.3 To check compliance with the requirement specified in paragraph 42.6.1.6, a Type-0 test must be carried out with the engine disconnected at an initial test speed of 30 km/h. The test shall be carried out with the laden vehicle.

42.6.2.9 The residual braking after transmission failure:

42.6.2.9.1 The residual performance of the service braking system, in the event of failure in a part of its transmission, must be checked by the Type-0 test with the engine disconnected from the initial speeds prescribed in paragraph 42.6.2.7.1.

42.6.2.9.2 The residual braking effectiveness test shall be conducted by simulating the actual failure conditions in the service braking system.

42.6.2.10 Distribution of Braking among the Axles of vehicles and The Compatibility between Towing Vehicles and Trailers:

42.6.2.10.1 Adhesion Utilization Curve:

42.6.2.10.1.1 The manufacturer shall provide the adhesion utilization curves for the front and rear axles calculated by the formulae:

$$f_1 = \frac{T_1}{N_1} = \frac{T_1}{P_1 + z \cdot \frac{h}{E} \cdot P \cdot g}$$

$$f_2 = \frac{T_2}{N_2} = \frac{T_2}{P_2 - z \cdot \frac{h}{E} \cdot P \cdot g}$$

where :

f_i = Adhesion utilized by axle i

T_i = Force exerted by the brakes on axle i under normal braking conditions on the road.

N_i = Normal reaction of road surface on axle i under braking

P_i = Normal reaction of road surface on axle i under static conditions

g = Acceleration due to gravity

z = Braking rate of vehicle

P = Mass of vehicle

h = height above ground of centre of gravity specified by the manufacturer and agreed by the authorities.

E =Wheelbase

42.6.2.10.1.2 The curves shall be plotted for both the following load conditions:

42.6.2.10.1.2.1 Unlden: in running order with the driver on board; in the case of a vehicle presented as a bare chassis-cab, a supplementary load may be added to simulate the mass of the body, not exceeding the minimum mass declared by the manufacturer.

42.6.2.10.1.2.2 Laden: where provision is made for several possibilities of load distribution, the one whereby the front axle is the most heavily laden shall be the one considered.

42.6.2.10.2 If it is not possible, for vehicles with (permanent) all-wheel drive, to carry out the mathematical verification pursuant to paragraph 42.6.2.10.1 above, the manufacturer may instead verify by means of a wheel lock sequence test:

42.6.2.10.2.1 The wheel lock sequence test shall be conducted on road surfaces with a coefficient of adhesion of not more than 0.3 and of about 0.8 (dry road).

42.6.2.10.2.2 Test Speed

42.6.2.10.2.2.1 60 km/h, but not exceeding 0.8 v_{max} for decelerations on low coefficient of friction road surfaces;

42.6.2.10.2.2.2 80 km/h, but not exceeding v_{max} for decelerations on high coefficient of friction road surfaces.

42.6.2.10.2.3 Pedal force is applied and increased such that the second wheel on the vehicle will reach lockup between 0.5 and 1 second after initiating the brake application, until lockup of both wheels on one axle occurs.

42.6.2.10.2.4 The tests shall be carried out twice on each road surface. If the result of one test fails, a third, hence decisive test shall be carried out.

42.6.3 The Performance Requirements of Vehicles of Categories M2, M3 and N:

42.6.3.1 Service Braking System:

42.6.3.1.1 The stopping distance and average deceleration can be designated as below table:

	Category	M_2	M_3	N_1	N_2	N_3

	Type of Test	0-I	0-I-II or IIA	0-I	0-I	0-I-II
Type-0 Test with Engine diconnected	s≤ d_m≥	$0.15v+\frac{v^2}{130}$ 5.0m/s²				
Type-0 Test With Engine Connected	s≤ d_m≥	$0.15v+\frac{v^2}{103}\cdot 5$ 4.0m/s²				
	F≤	700N				

where:

v = test speed, in km/h

s= stopping distance, in meter

d_m=mean fully developed deceleration, in m/s²

F= force applied to foot control, in N

42.6.3.1.2 In the case of a power-driven vehicle authorized to tow an unbraked trailer, the minimum performance prescribed for the corresponding power-driven vehicle category (for the Type-0 test with engine disconnected) must be attained with the unbraked trailer coupled to the power-driven vehicle and with the unbraked trailer laden to the maximum mass declared by the power-driven vehicle manufacturer.

42.6.3.1.3 The combination performance shall be verified by calculations referring to the maximum braking performance actually achieved by the power-driven vehicle alone (laden) during the Type-0 test with the engine disconnected, using the following formula:

$$d_{M+R}=d_M\cdot\frac{PM}{PM+PR}$$

where:

d_{M+R} = calculated mean fully developed deceleration of the power-driven vehicle when coupled to an unbraked trailer,

d_M= maximum mean fully developed deceleration of the power-driven vehicle alone achieved during the Type-0 test with engine disconnected,

PM= mass of power-driven vehicle (laden)

PR= maximum mass of an unbraked trailer which may be coupled, as declared by the power-driven vehicle manufacturer.

42.6.3.2 Secondary Braking System:

42.6.3.2.1 The secondary braking system, even if the control which actuates it is also used for other braking functions, must give a stopping distance not exceeding the following values and a mean fully developed deceleration not less than the following values:

42.6.3.2.1.1 M2 and M3 Category Vehicle: $0.15v + (2v^2/130)$; the second term corresponds to a mean fully developed deceleration: 2.5 m/s2

42.6.3.2.1.2 N Category Vehicle: $0.15v + (2v^2/115)$; the second term corresponds to a mean fully developed deceleration: 2.2 m/s^2

42.6.3.3 Parking Braking System:

42.6.3.3.1 The parking braking system must be capable of holding the laden vehicle stationary on a 18% up or down gradient.

42.6.3.3.2 On vehicles to which the coupling of a trailer is authorized, the parking braking system of the towing vehicle must be capable of holding the combination of vehicles stationary on a 12% up or down gradient.

42.6.3.3.3 A parking braking system which has to be actuated several times before it attains the prescribed performance is admissible.

42.6.3.3.4 The mean fully developed deceleration on application of the control of the parking brake system and the deceleration immediately before the vehicle stops shall not be less than 1.5 m/s2; the force exerted on the braking control device shall comply with the paragraph 42.6.3.4 below.

42.6.3.4 The exerted force of Secondary Braking System and Parking Braking System:

42.6.3.4.1 If the control is manual, the force applied to it must not exceed 600N.

42.6.3.4.2 If it is a foot control, the force exerted on the control must not exceed 700N.

42.6.3.5 The residual braking after transmission failure:

42.6.3.5.1 The residual performance of the service braking system, in the event of failure in a part of its transmission, must give a stopping distance not exceeding the following values and a mean fully developed deceleration not less than the following values:

Category	Laden		Unladen	
	s(m)	d_m (m/s^2)	s(m)	d_m (m/s^2)
M2	$0.15v + (100/30)\cdot(v^2/130)$	1.5	$0.15v + (100/25)\cdot(v^2/130)$	1.3
M3	$0.15v + (100/30)\cdot(v^2/130)$	1.5	$0.15v + (100/30)\cdot(v^2/130)$	1.5
N1	$0.15v + (100/30)\cdot(v^2/115)$	1.3	$0.15v + (100/25)\cdot(v^2/115)$	1.1
N2	$0.15v + (100/30)\cdot(v^2/115)$	1.3	$0.15v + (100/25)\cdot(v^2/115)$	1.1
N3	$0.15v + (100/30)\cdot(v^2/115)$	1.3	$0.15v + (100/25)\cdot(v^2/115)$	1.3

42.6.3.5.2 Use a control force not exceeding 700N.

42.6.3.6 Hot Performance:

42.6.3.6.1 Type-I Test:

42.6.3.6.1.1 For power-driven vehicles this hot performance must not be less than 80% of that prescribed for the category in question, nor less than 60% of the figure recorded in the Type-0 test with the engine disconnected.

42.6.3.6.1.2 In the case of a power-driven vehicle which satisfies the 60% requirement specified in paragraph above, but which cannot comply with the 80% requirement of paragraph above, a further hot performance test may be carried out using a control force not exceeding that specified in paragraph 42.6.3.1.1. The results of both tests shall be entered in the report.

42.6.3.6.2 Type-II Test: a stopping distance not exceeding the following values and a mean fully developed deceleration not less than the following values,

42.6.3.6.2.1 M3 Category Vehicle: $0.15v + (1.33v^2/130)$ (the second term corresponds to a mean fully developed deceleration dm = 3.75 m/s2)

42.6.3.6.2.2 N3 Category Vehicle: $0.15v + (1.33v^2/115)$ (the second term corresponds to a mean fully developed deceleration dm = 3.3 m/s^2)

42.6.3.6.3 Type-III Test: The hot brake-force at the periphery of the wheels must then not be less than 40% of the maximum stationary wheel load, and not less than 60% of the figure recorded in the Type-0 test at the same speed.

42.6.3.7 Type IIA Test:

42.6.3.7.1 The brakes must be cold; a brake is deemed to be cold when the temperature measured on the disc or on the outside of the drum is below 100℃.

42.6.3.7.2 If the performance of the braking action of the engine alone is determined by measuring the deceleration, it shall be sufficient if the mean deceleration measured is at least 0.6 m/s^2.

42.6.4 Performance of Braking Systems of Vehicle of Category O:

42.6.4.1 Service Braking System:

42.6.4.1.1 If the service braking system is of the continuous or semi-continuous type, the sum of the forces exerted on the periphery of the braked wheels shall be at least x% of the maximum stationary wheel load, x having the following values:

Category	Load	x (%)
Full Trailer/Central-Axle Trailer	Laden & Unladen	50
Semi-trailer	Laden & Unladen	45

42.6.4.1.2 If the trailer is fitted with a compressed-air braking system, the pressure in the supply line shall not exceed 700 kPa during the brake test (test speed 60 km/h) and the signal value in the control line shall not exceed the following values:

42.6.4.1.2.1 650 kPa in the pneumatic control line.

42.6.4.1.2.2 a digital demand value corresponding to 650 kPa in the electric control line.

42.6.4.1.3 Vehicles equipped with the inertia braking system, it shall comply with the following provisions:

42.6.4.1.3.1 Declararion of conformance of design: applicant shall ensure and declare to comply with this regulation.

42.6.4.1.3.1.1 In hydraulic-transmission inertia braking systems a check shall be made to verify that the travel of the master cylinder is not less than the maximum displacement of coupling head.

42.6.4.1.3.1.2 $G_A \leq G'_A$ trailer's "maximum mass" capable of being braked by the control device, as declared by the manufacturer.（G_A：Technically permissible maximum mass）

42.6.4.1.3.2 Testing requirements:

42.6.4.1.3.2.1 Inertia braking devices must be so arranged that in the case when the coupling head travels to its fullest extent, no part of the transmission seizes, undergoes permanent distortion, or breaks.

42.6.4.1.3.2.2 When it is exercised with the practical braking operation, the self-actuation or unexpected control cannot occur in the braking mechanism of trailer.

42.6.4.1.3.2.3 The inertia braking system must allow the trailer to be reversed with the towing vehicle without imposing a sustained drag force exceeding $0.08 \cdot g \cdot G_A$ (G_A：technically permissible maximum mass). Devices used for this purpose must act automatically and disengage automatically when the trailer moves forward. Any special device incorporated for this purpose shall be such that the parking performance when facing up a gradient shall not be adversely affected.

42.6.4.1.4 The vehicles of category O1(if equipped with service braking system), O2 and O3 must be conducted with type-I test. In the Type-I test of a semi-trailer, the mass braked by the latter's axle(s) must correspond to the maximum axle load(s) (not including the king pin load).

42.6.4.1.5 The vehicles of category O4 must undergo the Type- test. In the Type- III test of a semi-trailer, the mass braked by the latter's axle(s) must correspond to the maximum axle load(s).

42.6.4.1.6 However, in the case of trailers, the hot brake force at the periphery of the wheels when tested at 40 km/h must not be less than 36 □of the maximum stationary wheel load, nor less than 60 □of the figure recorded in the Type-0 test at the same speed.

42.6.4.1.7 Hot performance of Type III test：The hot brake-force at the periphery of the wheels must then not be less than 40 □ of the maximum stationary wheel load, and not less than 60 □ of the figure recorded in the Type-0 test at the same speed.

42.6.4.2 Parking Braking System: The parking braking system with which the trailer is equipped must be capable of holding the laden trailer stationary, when separated from the towing vehicle, on an 18% up or down-gradient. The force applied to the control device must not exceed 600 N.

42.6.4.3 Automatic Braking System: The automatic braking performance, when testing the laden vehicle from a speed of 40 km/h, shall not be less than 13.5% of the maximum stationary wheel load. Wheel-locking at performance levels above 13.5% is

permitted.

42.6.5 Response Time: Where a vehicle is equipped with a service braking system which is totally or partially dependent on a source of energy other than the muscular effort of the driver, the following requirements must be satisfied in an emergency manoeuvre:

42.6.5.1 The time elapsing between the moment when the control device begins to be actuated and the moment when the braking force on the least favourably placed axle reaches the level corresponding to the prescribed performance must not exceed 0.6 seconds.

42.6.5.2 In the case of vehicles fitted with compressed-air braking systems, it is considered to be satisfied if the vehicle complies with the following provisions:

42.6.5.2.1 Vehicles of Categories M and N:

42.6.5.2.1.1 For an actuating time of 0.2 seconds, the time elapsing from the initiation of the braking system control actuation to the moment when the pressure in the brake cylinder reaches 75% of its asymptotic value shall not exceed 0.6 seconds.

42.6.5.2.1.2 The time elapsing from the initiation of brake-pedal actuation to the moment when:

42.6.5.2.1.2.1 the pressure measured at the coupling head of the pneumatic control line,

42.6.5.2.1.2.2 the digital demand value in the electric control line. reaches x% of its asymptotic, respectively final, value shall not exceed the times shown in the table below:

x (%)	t (sec)
10	0.2
75	0.4

42.6.5.2.1.3 In the case of power-driven vehicles authorized to tow trailers of categories O3 or O4, the following test conducted and verified:

42.6.5.2.1.3.1 by measuring the pressure at the extremity of a pipe 2.5 m long with an internal diameter of 13 mm which shall be joined to the coupling head of the supply line;

42.6.5.2.1.3.2 by simulating a failure of the control line at the coupling head;

42.6.5.2.1.3.3 by actuating the service braking control device in 0.2 seconds.

42.6.5.2.2 For the vehicles of category O with a pneumatic control line the time elapsing between the moment when the pressure produced in the control line by the simulator reaches 0.65 bar and the moment when the pressure in the brake actuator of the trailer reaches 75% of its asymptotic value must not exceed 0.4 seconds.

42.6.5.2.3 For the vehicles of category O with an electric control line the time elapsing between the moment when the signal produced by the simulator exceeds the equivalent of 0.65 bar and the moment when the pressure in the brake actuator of the trailer reaches 75% of its asymptotic value must not exceed 0.4 seconds.

42.6.5.3 In the case of vehicles fitted with hydraulic braking systems, the requirements of paragraph 42.6.5.1 above are considered to be satisfied if, in an emergency manoeuvre, the deceleration of the vehicle or the pressure at the least favourable brake cylinder, reaches a level corresponding to the prescribed performance within 0.6 seconds.

42.6.6 Distribution of braking among the axles of vehicles and requirements for compatibility between towing vehicles and trailers: Vehicles which are not equipped with an anti-lock system shall meet all the requirements of this regulation.

42.6.6.1 Two-Axled Vehicle

42.6.6.1.1 For all categories of vehicles for k values between 0.2 and 0.8: $z \geq 0.1 + 0.85(k - 0.2)$

42.6.6.1.2 Adhesion Utilization Curve: For all states of load of the vehicle, the adhesion utilization curve of the rear axle shall not be situated above that for the front axle:

42.6.6.1.2.1 For all braking rates between 0.15 and 0.80 in the case of vehicles of category M1 and vehicles of category N1 with a laden/unladen rear axle loading ratio not exceeding 1.5 or having a maximum mass of less than 2 t. However, for vehicles of this category in the range of z values between 0.30 and 0.45, an inversion of the adhesion utilization curves is permitted provided that the adhesion utilization curve of the rear axle does not exceed by more than 0.05 the line defined by the formula $k = z$ (line of ideal adhesion utilization - see diagram 1A);

42.6.6.1.2.2 For all braking rates between 0.15 and 0.50 in the case of vehicles of category N1. This condition is also considered satisfied if, for braking rates between 0.15 and 0.30, the adhesion utilization curves for each axle are situated between two lines parallel to the line of ideal adhesion utilization given by the equation k = z +/- 0.08 as shown in diagram 1B where the adhesion utilization curve for the rear axle may cross the line k = z - 0.08; and complies for a braking rate between 0.30 and 0.50, with the relation z > k - 0.08; and between 0.50 and 0.61 with the relation z > 0.5k + 0.21.

42.6.6.1.2.3 For all braking rates between 0.15 and 0.30 in the case of vehicles of other categories. This condition is also considered satisfied if, for braking rates between 0.15 and 0.30, the adhesion utilization curves for each axle are situated between two lines parallel to the line of ideal adhesion utilization given by the equation k = z +/- 0.08 as shown in diagram 1C and the adhesion utilization curve for the rear axle for braking rates z □ 0.3 complies with the relation z □ 0.3 + 0.74 (k - 0.38).

42.6.6.1.3 In the case of a power-driven vehicle authorized to tow trailers of category O3 or O4 fitted with compressed-air braking systems:

42.6.6.1.3.1 When tested with the energy source stopped, the supply line blocked off, a reservoir of 0.5 litre capacity connected to the pneumatic control line, and the system at cut-in and cut-out pressures, the pressure at full application of the braking control shall be between 650 kPa and 850 kPa bar at the coupling heads of the supply line and the pneumatic control line, irrespective of the load condition of the vehicle.

42.6.6.1.3.2 For vehicles equipped with an electric control line; a full application of the control of the service braking system shall provide a digital demand value corresponding to a pressure between 650 kPa and 850 kPa bar.

42.6.6.1.3.3 These values shall be demonstrably present in the power-driven vehicle when uncoupled from the trailer. The compatibility bands in the diagrams 2, 3 and 4, should not be extended beyond 750 kPa and/or the corresponding digital demand value.

42.6.6.1.3.4 It must be ensured that at the coupling head of the supply line a pressure of at least 700 kPa is available when the system is at cut-in pressure. This pressure shall be demonstrated without applying the service brakes.

42.6.6.1.4 Wheel Lock Sequence Test:

42.6.6.1.4.1 For all braking rates between 0.15 and 0.8, lockup of the front wheels occurs either simultaneously with or before the lockup of the rear wheels.

42.6.6.1.4.2 A simultaneous lockup of the front and rear wheels refers to the condition when the time interval between the lockup of the last (second) wheel on the rear axle and the last (second) wheel on the front axle is < 0.1 seconds for vehicle speeds > 30 km/h.

42.6.6.1.4.3 Pedal Force: It may exceed the foresaid paragraph 42.6.3.1.1.

42.6.6.1.5 Towing vehicles other than tractors for semi-trailers : In the case of a power-driven vehicle authorized to tow trailers of category O3 or O4 fitted with a compressed air braking system, the permissible relationship between the braking rate T_M / P_M and the pressure p_m shall lie within the areas shown on diagram 2 for all pressures between 0.2 and 7.5 bar.

42.6.6.1.6 Tractors for Semi-Trailers:

42.6.6.1.6.1 Tractors with unladen semi-trailer:

42.6.6.1.6.1.1 An unladen combination is understood to be a tractor in running order, with the driver on board, coupled to an unladen semi-trailer.

42.6.6.1.6.1.2 The dynamic load of the semi-trailer on the tractor shall be represented by a static mass P_s mounted at the fifth wheel coupling equal to 15% of the maximum mass on the coupling. The braking forces must continue to be regulated between the state of the "tractor with unladen semi-trailer" and that of the "tractor alone"; the braking forces relating to the "tractor alone" shall be verified.

42.6.6.1.6.2 Tractors with laden semi-trailer:

42.6.6.1.6.2.1 A laden combination is understood to be a tractor in running order, with the driver on board, coupled to a laden semi-trailer.

42.6.6.1.6.2.2 The dynamic load of the semi-trailer on the tractor shall be represented by a static mass P_s mounted at the fifth wheel coupling equal to: $P_s = P_{s0}(1 + 0.45z)$

where, P_{s0} represents the difference between the maximum laden mass of the tractor and its unladen mass.For h the following value shall be taken:

$$h = \frac{h_0 \cdot P_0 + h_s \cdot P_s}{P}$$

where,

h_0 = the height of the center of gravity of the tractor;

h_s = the height of the coupling on which the semi-trailer rests;

P_0 = the unladen mass of the tractor alone.

$$P = P_0 + P_s = \frac{P_1 + P_2}{g}$$

42.6.6.1.6.2.3 In the case of a vehicle fitted with a compressed air braking system, the permissible relationship between the braking rate T_M / P_M and the pressure p_m shall be within the areas shown on diagram 3 for all pressures between 20 and 750 kPa.

42.6.6.2 Vehicles with more than two axles: The requirements of paragraph 42.6.6.1 shall apply to vehicles with more than two axles. The requirements of paragraph 42.6.6.1.4 with respect to wheel lock sequence shall be considered to be met if, in the case of braking rates between 0.15 and 0.30, the adhesion utilized by at least one of the front axles is greater than that utilized by at least one of the rear axles.

42.6.6.3 For semi-trailers fitted with compressed-air braking systems:

42.6.6.3.1 The permissible relationship between the braking rate T_R / P_R and the pressure p_m shall lie within two areas derived from diagrams 4A and 4B for all pressures between 20 and 750 kPa, in both the laden and unladen states of load.

42.6.6.3.2 If the requirements of paragraph 42.6.6.3.1 above cannot be satisfied in conjunction with the requirements of paragraph 42.6.4.1.1 for semi-trailers with a K_c factor less than 0.80, then the semi-trailer must meet the minimum braking performance specified in paragraph 42.6.4.1.1 and be fitted with an approved anti-lock system.

42.6.6.4 Requirements for Full and Centre-Axle Trailers:

42.6.6.4.1 For full trailers fitted with compressed-air braking systems:

42.6.6.4.1.1 The requirements set out in paragraph 42.6.6.1 shall apply to twin-axle trailers (except where the axle spread is less than 2 m).

42.6.6.4.1.2 Full trailers with more than two axles shall be subject to the requirements of paragraph 42.6.6.2.

42.6.6.4.1.3 The permissible relationship between the braking rate T_R / P_R and the pressure p_m shall lie within the designated areas in diagram 2 for all pressures between 20 and 750 kPa, in both the laden and unladen states of load.

42.6.6.4.2 For centre-axle trailers fitted with compressed-air braking systems:

42.6.6.4.2.1 The permissible relationship between the braking rate T_R / P_R and the pressure p_m shall lie within two areas derived from diagram 2, by multiplying the vertical scale by 0.95. This requirement shall be met at all pressures between 20 and 750 kPa, in both the laden and unladen states of load.

42.6.6.4.2.2 If the requirements of paragraph 42.6.4.1.1 to this Regulation cannot be satisfied due to lack of adhesion, then the centre-axle trailer must be fitted with an antilock system.

42.6.6.5 Requirements to be met in case of failure of the braking distribution system:

42.6.6.5.1 It shall be possible, in the event of the failure of its control, to stop the vehicle under the conditions specified for secondary braking in the case of power-driven vehicles;

42.6.6.5.2 For those power-driven vehicles authorized to tow a trailer fitted with compressed-air braking systems, it must be

possible to achieve a pressure at the coupling head of the control line within the range specified in paragraph 42.6.6.1.3.

42.6.6.5.3 In the event of failure of the control of the device on trailers, a service braking performance of at least 30% of that prescribed for the vehicle in question shall be attained.

42.6.7 Braking system with stored energy

42.6.7.1 In the event of failure in any part of the transmission of a braking system, the feed to the part not affected by the failure must continue to be ensured if required for the purpose of halting the vehicle with the degree of effectiveness prescribed for residual and/or secondary braking. This condition must be met by means of devices which can be easily actuated when the vehicle is stationary, or by automatic means.

42.6.7.2 Furthermore, storage devices located down-circuit of this device must be such that in the case of a failure in the energy supply after four full-stroke actuations of the service brake control, it is still possible to halt the vehicle at the fifth application, with the degree of effectiveness prescribed for secondary braking.

42.6.7.3 Vehicles equipped with a hydraulic braking system with stored energy which cannot meet the requirements of paragraph 42.6.7.1 of this Regulation shall be deemed to satisfy that paragraph if the following requirements are met: After any single transmission failure it shall still be possible after eight full-stroke actuations of the service brake control to achieve, at the ninth application, at least the performance prescribed for the secondary braking system.

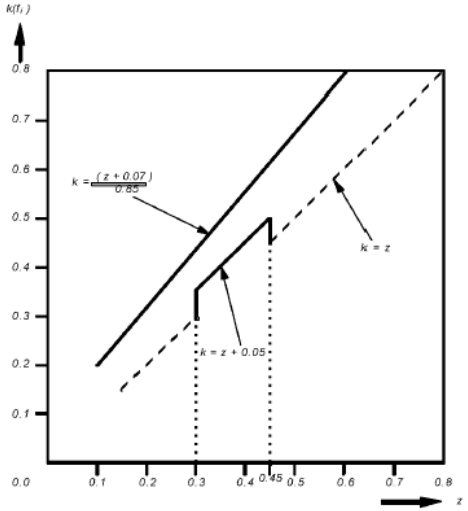

Diagram 1A. M1 Category and Specific N1 Category Vehicle

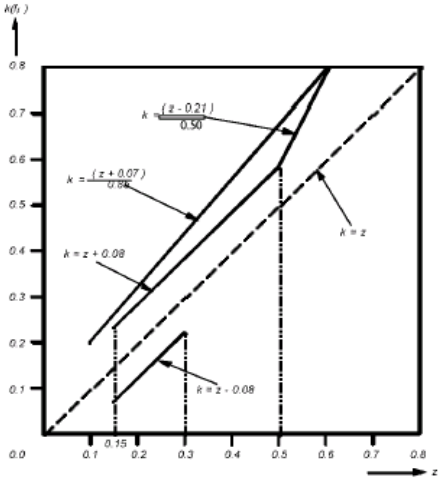

Diagram 1B. N1 Category (Except specific N1 Category Vehicle)

Remark：The lower limitation of k=z-0.08 is not applicable to the adhesion application of rear axle.

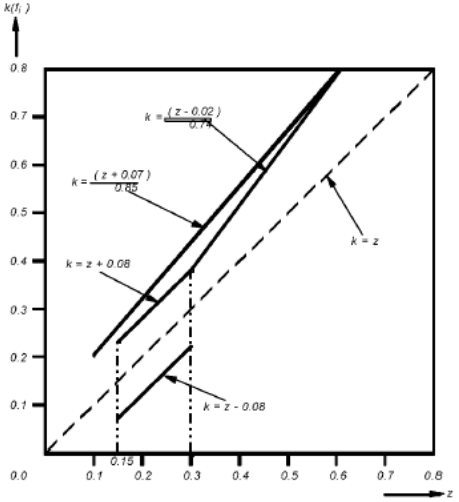

Diagram 1C. The Power-Driven Vehicle except N1 Category Vehicle

Remark：The lower limitation of k=z-0.08 is not applicable for the adhesion utilization of rear axle.

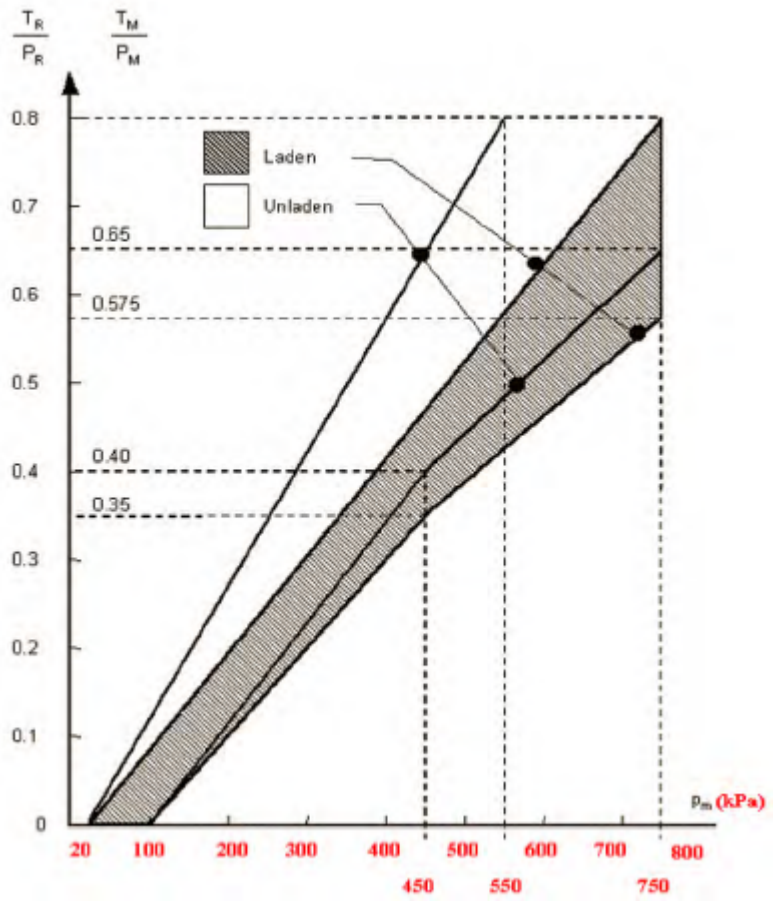

Diagram 2 Towing vehicles & Trailer (except tractors for semi-trailers &semi- trailers)

Remark：The relationships required by the diagram shall apply progressively for intermediate states of loading between the laden and the unladen states and shall be achieved by automatic means.

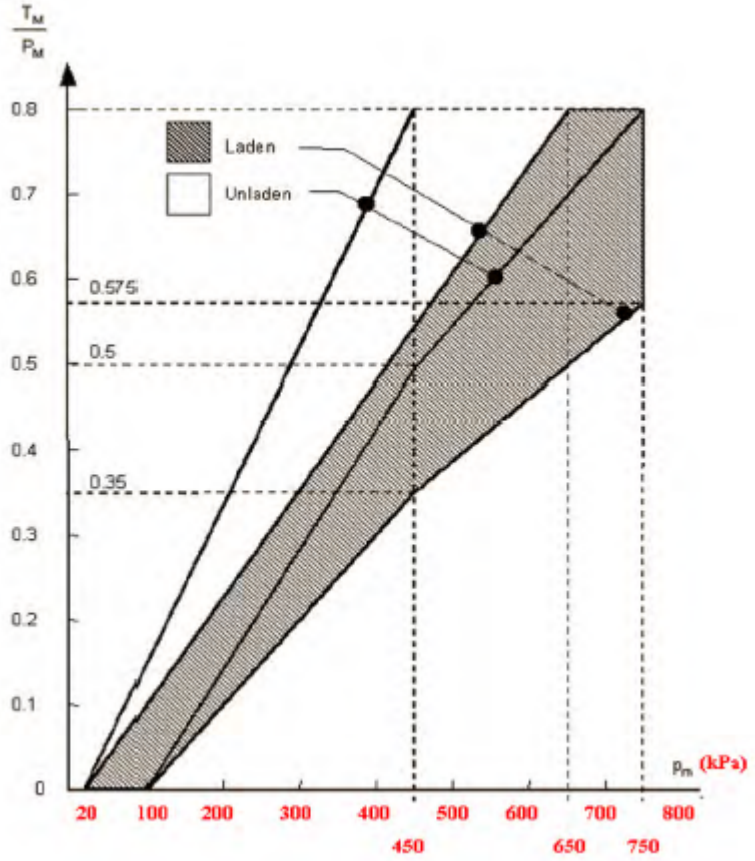

Diagram 3 Tractors for semi trailers

Remark：The relationships required by the diagram shall apply progressively for intermediate states of loading between the laden and the unladen states and shall be achieved by automatic means.

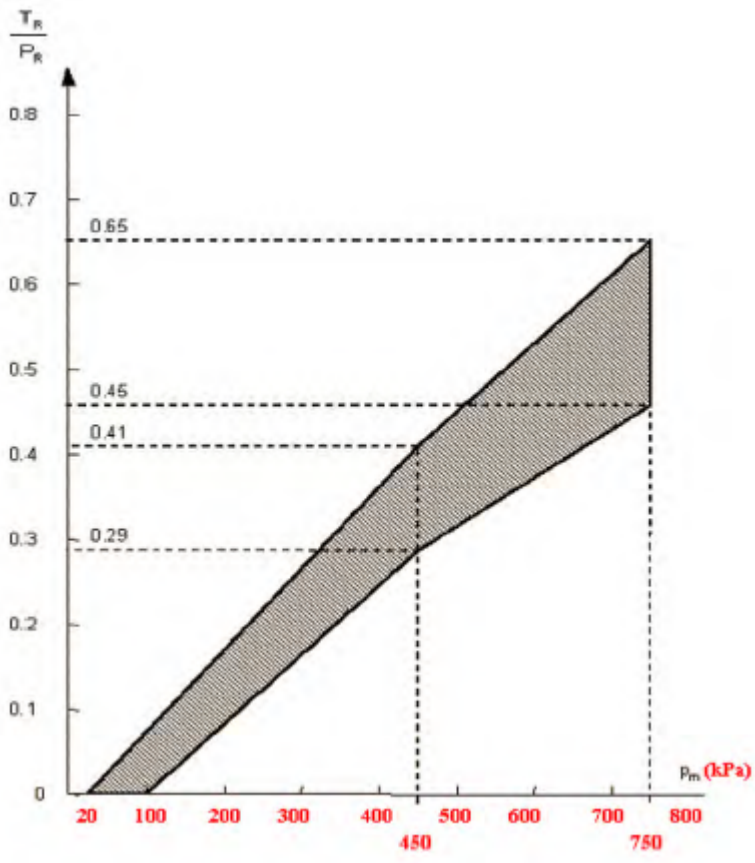

Diagram 4A Semi-Trailers

Remark : The relation between the braking rate T_R/P_R and the control line pressure for the laden and unladen conditions is determined as follows :
The factors Kc (laden), Kv (unladen) are obtained by reference to diagram 4B. To determine the areas corresponding to the laden and unladen conditions, the values of the ordinates of the upper and lower limits of the hatched area in diagram 4A are multiplied by the factors Kc and Kv respectively.

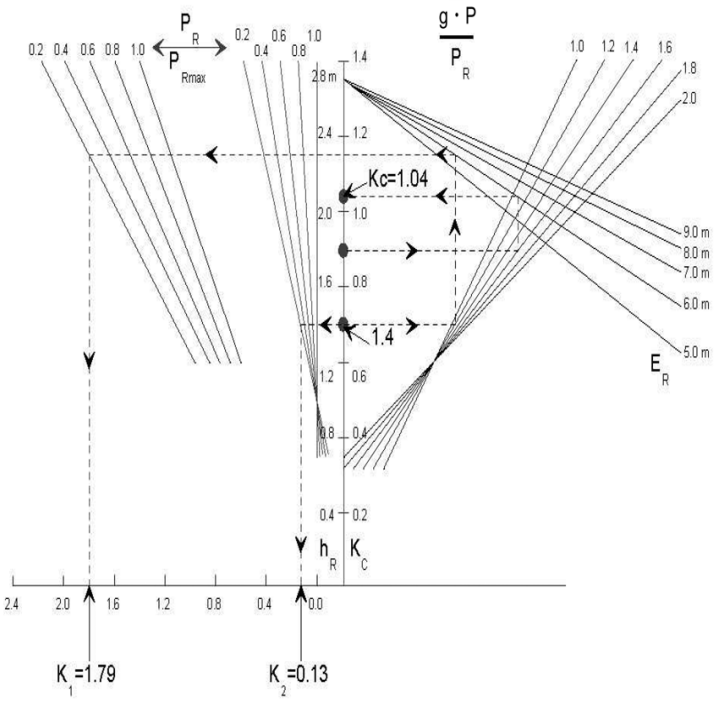

Diagram 4B （see the 4th paragraph of F(III) and diagram 4A）

Formula from which diagram 4B is derived：

$$K = \left[1.7 - \frac{0.7P_R}{P_{R_{\max}}}\right]\left[1.35 - \frac{0.96}{E_R}\left(1.0 + (h_R - 1.2)\frac{g \cdot P}{P_R}\right)\right] - \left[1.0 - \frac{P_R}{P_{R_{\max}}}\right]\left[\frac{h_R - 1.0}{2.5}\right]$$

42.7 Dynamic Braking for vehicles of category symbols L1 and L3:

42.7.1 General Specifications：

42.7.1.1 The braking device shall be so designed, constructed and fitted as to enable the vehicle in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation.

42.7.1.2 Brake linings shall not contain asbestos. Wear of the brakes must be capable of being easily taken up by means of either manual or automatic adjustment. The brakes shall be capable of being adjusted to an efficient operating position until the brake linings have worn to the point of requiring replacement.

42.7.1.3 Every vehicle of category symbols L1 and L3 shall be equipped with two service braking devices, with independent controls

and transmissions, one acting at least on the front wheel and the other at least on the rear wheel. The two service braking devices may have a common brake so long as a failure in one braking device does not affect the performance of the other.

42.7.1.4 The braking devices shall operate freely when correctly lubricated and adjusted. When correctly adjusted the components of a braking device shall not, when operated, contact anything other than the intended parts.

42.7.1.5 In braking devices where the transmission is hydraulic, the receptacles containing the reserve fluid must be so designed and constructed that the level of the reserve fluid can be easily checked.

42.7.1.6 The component parts of all braking devices, where attached to the vehicle, shall be so secured that the braking devices do not fail in their function under normal operating conditions.

42.7.1.7 Driver mass: means the nominal mass of a driver that shall be 75 kg (subdivided into 68 kg occupant mass at the seat and 7 kg luggage mass).

42.7.2 Braking Test:

42.7.2.1 General:

42.7.2.1.1 The performance of a braking device shall be determined by measuring the stopping distance in relation to the initial speed of the vehicle and/or measuring the mean fully developed deceleration during the test.

42.7.2.1.1.1 The stopping distance: shall be the distance covered by the vehicle from the moment when the driver begins to actuate the control of the braking system until the moment when the vehicle stops.

42.7.2.1.1.2 The mean fully developed deceleration, (d_m), shall be calculated as the deceleration averaged with respect to distance over the interval V_b to V_e according to the following formula:

$$d_m = \frac{v_b^2 - v_e^2}{25.92(S_e - S_b)}$$

where:

V_0= the speed at the moment when the driver begins to actuate the control of the braking system (km/h); shall not be less than 98% of the prescribed speed for the test in question.

V_b= vehicle speed at 0.8 V_0(km/h).

V_e= vehicle speed at 0.1 V_0 (km/h).

S_b=The distance traveled between V_0 and V_b, in m

S_e= The distance traveled between V_0 and V_e, in m

42.7.2.1.2 The braking performance shall be measured during road tests described below and conducted under the following conditions, the prescribed performance must be obtained without locking of the wheel(s), without deviation of the vehicle from its course and without any abnormal vibration; during the tests the force applied to the brake control in order to obtain the prescribed performance must not exceed the maximum laid down in paragraph 42.7.3 below for the test vehicle's category.

42.7.2.1.3 The tests must be performed when there is no wind liable to affect the test result.

42.7.2.1.4 The test area must be level, dry and have a surface affording good adhesion, unless specified otherwise in the

relevant regulation;

42.7.2.1.5 At the start of the test or any series of tests the tyres must be cold and at the pressure prescribed for the load actually borne by the wheels when the vehicle is stationary;

42.7.2.1.6 For all Type-0 tests the brakes must be cold: a brake is deemed to be cold when the temperature measured on the disc or on the outside of the drum is below 100℃.

42.7.2.1.7 The vehicle shall be loaded, when required to be tested in the laden condition, with the mass distributed in accordance with the manufacturer's requirement.

42.7.2.1.8 The driver shall be seated in the saddle as for normal driving and shall maintain the same position throughout the test.

42.7.2.1.9 Prescribed speed relating to tests of vehicles with braking devices operating on the wheel or wheels of the front or rear axle only, and vehicles of which (at least) one of the braking devices is a combined braking system:

42.7.2.1.9.1 40km/h for vehicles of category symbol L1.

42.7.2.1.9.2 60km/h for vehicles of category symbol L3.

42.7.2.1.9.3 Vehicles of which the maximum speed (Vmax) is lower than 45 km/h in the case of category symbol L1, or 67 km/h in the case of category symbol L3, shall be tested at a speed equal to 0.9 Vmax.

42.7.2.2 Type -0 Test:

42.7.2.2.1 Type-0 Test with engine disconnected (Neutral Gear)：

42.7.2.2.1.1 In the case of vehicles where the two service brakes can be applied separately, the braking devices shall be tested separately. The minimum performance for each braking device for each category of vehicle must be attained

42.7.2.2.1.2 In the case of a vehicle with a manual gear box or an automatic transmission where the gear box can be disengaged manually, the tests shall be carried out with the gear box inoperative and/or the engine disconnected by clutch disengagement or otherwise;

42.7.2.2.1.3 In the case of a vehicle with other types of automatic transmission where the gear box can not be disengaged manually, the tests shall be carried out under the normal operating conditions.

42.7.2.2.2 Type-0 test with engine connected for vehicles of category symbol L3 (Driving Gear):

42.7.2.2.2.1 Tests must be carried out in the unladen condition at various speeds, the lowest being equal to 30% of the maximum speed of the vehicle and the highest being equal to 80% of that speed or 160 km/h whichever is the lower.

42.7.2.2.2.2 In the case where two service braking devices can be applied separately, both these braking devices shall be tested together and simultaneously, with the vehicle unladen.

42.7.2.2.3 Type-0 test with engine disconnected (Neutral Gear): with WET BRAKES. This test shall (subject to the exemption of the enclosed brakes) be carried out on vehicles of category symbols L1 and L3. The test procedure is identical to that for the Type-0 test with engine disconnected, except for the provisions for wetting the brakes described in paragraph 42.7.2.3 below.

42.7.2.2.4 Enclosed Brakes: Conventional drum brakes or fully enclosed disc brakes which are not subject to water penetration under normal running conditions.

42.7.2.3 Test procedures for wet brakes:

42.7.2.3.1 Baseline Test: The control force used shall be equivalent to that required to attain a deceleration of 2.5 m/s2 with dry brake(s) during Type-0 test with engine disconnected.

42.7.2.3.2 Wet Brakes Test:

42.7.2.3.2.1 Actuate the wet brake test mentioned as below and also comply with the requirements to wetting the brake correctly.

42.7.2.3.2.2 Use the control force determined from the foresaid Baseline Test to attain a deceleration value.

42.7.2.4 Special provisions relating to testing with wet brakes:

42.7.2.4.1 The test with brakes subject to wetting shall be carried out under the same conditions as the test with dry brakes. There shall be no adjustment or alteration of the braking system other than fitting the equipment to allow brake wetting.

42.7.2.4.2 The test equipment shall continuously wet the brakes for each test run at a flow rate of 15 l/h for each brake. Two disc brakes on one wheel will be considered as two brakes.

42.7.2.4.3 For exposed or partly exposed disc brakes, the prescribed amount of water shall be directed on to the rotating disc in such a manner that it is equally distributed on the surface or surfaces of the disc swept by the friction pad or pads:

42.7.2.4.3.1 For fully exposed disc brakes, the water shall be directed on to the surface(s) of the disc 45 degrees in advance of the friction pad(s);

42.7.2.4.3.2 For partly exposed disc brakes, the water shall be directed on to the surface(s) of the disc 45 degrees in advance of the shield or baffle.

42.7.2.4.3.3 The water shall be directed on the surface(s) of the disc(s) in a continuous jet, in a direction perpendicular to the surface of the disc, from single jet nozzles so positioned as to be between the inner extremity and a point two thirds of the distance from the outer extremity of that part of the disc swept by the friction pad(s) .See figure 5.

42.7.2.4.4 For fully enclosed disc brakes, where the provisions of paragraph 42.7.2.2.4 above do not apply, the water shall be directed on to both sides of the shield or baffle at a point and in a manner corresponding with that described in subparagraphs 42.7.2.4.3.1 and 42.7.2.4.3.3. Where the nozzle would be coincident with a ventilation or inspection port, the water shall be applied one quarter of a revolution in advance of the said port.

42.7.2.4.5 Where it is not possible to apply the water in the position specified owing to the presence of some fixed part of the vehicle, the water shall be applied at the first point, exceeding 45 degrees where uninterrupted application is possible.

42.7.2.4.6 For drum brakes, where the provisions of paragraph 42.7.2.2.4 above do not apply, the prescribed amount of water shall be distributed equally on either side of the braking device (that is, on the stationary back plate and the rotating drum) from nozzles so positioned as to be two-thirds of the distance from the outer circumference of the rotating drum to the wheel hub.

42.7.2.4.7 To ensure the correct wetting of the brake(s), the vehicle shall be driven, immediately before the commencement of the test series:

42.7.2.4.7.1 With the wetting equipment functioning continuously as prescribed above.

42.7.2.4.7.2 At the prescribed test speed
42.7.2.4.7.3 Without the operation of the braking device(s) to be tested
42.7.2.4.7.4 For a distance of not less than 500 m prior to the point at which the test is to be carried out.

42.7.2.5 Type-I Test (Fade Test):

42.7.2.5.1 The service brakes of all vehicles of categories L3 must be tested by a series of repeated stops, the vehicle being in the laden condition. For vehicles equipped with a combined braking system, it will be sufficient to submit this service braking device to the type-I test.

42.7.2.5.2 The test procedures are:

42.7.2.5.2.1 A single Type-0 test.
42.7.2.5.2.2 A series of 10 repeated stops carried out in accordance with the requirements of paragraph below.
42.7.2.5.2.3 A single Type-0 test, carried out in the same conditions (and in particular at a control force as constant as possible of which the mean value is no greater than the mean force actually used in paragraph 42.7.2.5.2.1 as those used for the test in subparagraph 42.7.2.5.2.1 above as soon as possible after the completion of the test specified in subparagraph 42.7.2.5.2.2 above but, in any case, within one minute thereof.

42.7.2.5.3 Test Conditions:

42.7.2.5.3.1 The initial test speed shall be:

42.7.2.5.3.1.1 For testing the front brake(s): whichever is the lower of 70% of the vehicle's maximum speed and 100 km/h;
42.7.2.5.3.1.2 For testing the rear brake(s): whichever is the lower of 70% of the vehicle's maximum speed and 80 km/h;
42.7.2.5.3.1.3 For testing a combined braking system: whichever is the lower of 70% of the vehicle's maximum speed and 100 km/h;

42.7.2.5.3.2 The distance between the initiation of one stop and the initiation of the next shall be 1,000 m.
42.7.2.5.3.3 The use of the gear box and/or clutch shall be as follows:

42.7.2.5.3.3.1 In the case of a vehicle with a manual gear box or an automatic transmission where the gear box can be disengaged manually, the highest gear, consistent with attaining the initial test speed, shall be engaged during the stops. When the vehicle speed has fallen to 50% of the initial test speed, the engine shall be disengaged.
42.7.2.5.3.3.2 In the case of a vehicle with a fully automatic transmission, the test shall be carried out under the normal operating conditions for such equipment. For the approach, the gear suitable to the initial test speed shall be used.

42.7.2.5.3.4 After each stop, the vehicle shall immediately be subjected to maximum acceleration to reach the initial test speed and maintained at that speed until the initiation of the next stop.
42.7.2.5.3.5 The force applied to the control must be so adjusted as to maintain a mean deceleration of 3 m/s2 or the maximum deceleration achievable with that brake, whichever is the lower, at the first stop: this force must remain constant throughout the succeeding stops

42.7.2.5.4 Residual Performance: At the end of the type-I test the residual performance of the service braking device must be

measured in the same conditions (and in particular at a control force as constant as possible the mean value of which is not greater than the mean force actually used) as for the Type-0 test with the engine disconnected (the temperature conditions may be different).

42.7.2.6 Test for a combined braking system: For the purposes of the type-I residual performance test (vehicles of category L3), it is tested with the initial vehicle speed mentioned in foresaid 42.7.2.1.9 under both unladen and laden conditions.

42.7.3 Performance:

42.7.3.1 Type-0 Test and Type-I Test

42.7.3.1.1 Braking with the front brake only:

Category	Stopping Distance S (m)	Mean Fully Developed Deceleration(m/s^2)
L1	$S \le 0.1 \cdot v + v^2 / 90$	3.4
L3	$S \le 0.1 \cdot v + v^2 / 115$	4.4*

Remark:

*: If the values for single braking devices cannot be achieved because of limited adhesion, the following values shall be substituted for a test with the vehicle laden, using both braking devices together: 5.8 m/s^2.

42.7.3.1.2 Braking with the rear brake only:

Category	Stopping Distance S (m)	Mean Fully Developed Deceleration(m/s^2)
L1	$S \le 0.1 \cdot v + v^2 / 70$	2.7
L3	$S \le 0.1 \cdot v + v^2 / 75$	2.9*

Remark:

*: If the values for single braking devices cannot be achieved because of limited adhesion, the following values shall be substituted for a test with the vehicle laden, using both braking devices together: 5.8 m/s^2.

42.7.3.1.3 Braking performance with the vehicle unladen: A practical test of the vehicle ridden by the driver alone shall not be required if a calculation shows that the distribution of the mass on the braked wheels allows a mean fully developed deceleration of at least 2.5 m/s2or a stopping distance $S \le 0.1v + v^2 / 65$ to be achieved with each of the single axle braking devices.

42.7.3.1.4 Residual Performance:

42.7.3.1.4.1 This residual performance must not be, if expressed as a deceleration, less than 60% of the deceleration figure achieved during the Type-0 test,

42.7.3.1.4.2 This residual performance must not be, if expressed as a stopping distance, more than the stopping distance figure, calculated in accordance with the following formula:

$$S_2 \le 1.67 S_1 - 0.67 \cdot a \cdot v$$

where:

S_1 = the stopping distance achieved in the Type-0 test

S_2 =The stopping distance as recorded in the residual performance test

a =0.1

v = the initial speed at the beginning of braking as defined in paragraph 42.7.2.1.9.

42.7.3.2 Braking with the combined braking system only:

Category	Stopping Distance S (m)	Mean Fully Developed Deceleration (m/s^2)
L1	$S \le 0.1 \cdot v + v^2/115$	4.4
L3	$S \le 0.1 \cdot v + v^2/132$	5.1

42.7.3.3 The Secondary Braking system (if equipped): The stopping distance must be $S \le 0.1v + v^2/65$, corresponding mean fully developed deceleration 2.5 m/s2.

42.7.3.4 Braking performance with the parking braking device (if applicable): The parking braking device must, even if it is combined with one of the other braking devices, be capable of holding the laden vehicle stationary on an 18% up or down gradient.

42.7.3.5 Forces applied to:

42.7.3.5.1 service brake controls:

42.7.3.5.1.1 hand control □ 200 N.

42.7.3.5.1.2 foot control □ 350 N.

42.7.3.5.2 parking brake control(if applicable):

42.7.3.5.2.1 with manual control □ 400 N.

42.7.3.5.2.2 with foot control □ 500 N.

42.7.3.5.3 In the case of hand brake levers, the point of application of the manual force shall be assumed to be 50 mm from the outer end of the lever.

42.7.3.6 Performance levels to be attained with wet brakes:

42.7.3.6.1 The mean deceleration to be attained with wet brake(s) between 0.5 and 1.0 second after application of the brake shall be at least 60% of that attained with dry brake(s) when the same control force is applied.

42.7.3.6.2 The control force used, which must be applied as quickly as possible, shall be equivalent to that required to attain a deceleration of 2.5 m/s2 with dry brake(s).

42.7.3.6.3 At no time during the Type-0 test with wet brake(s) shall the deceleration exceed 120% of that attained with dry brake(s).

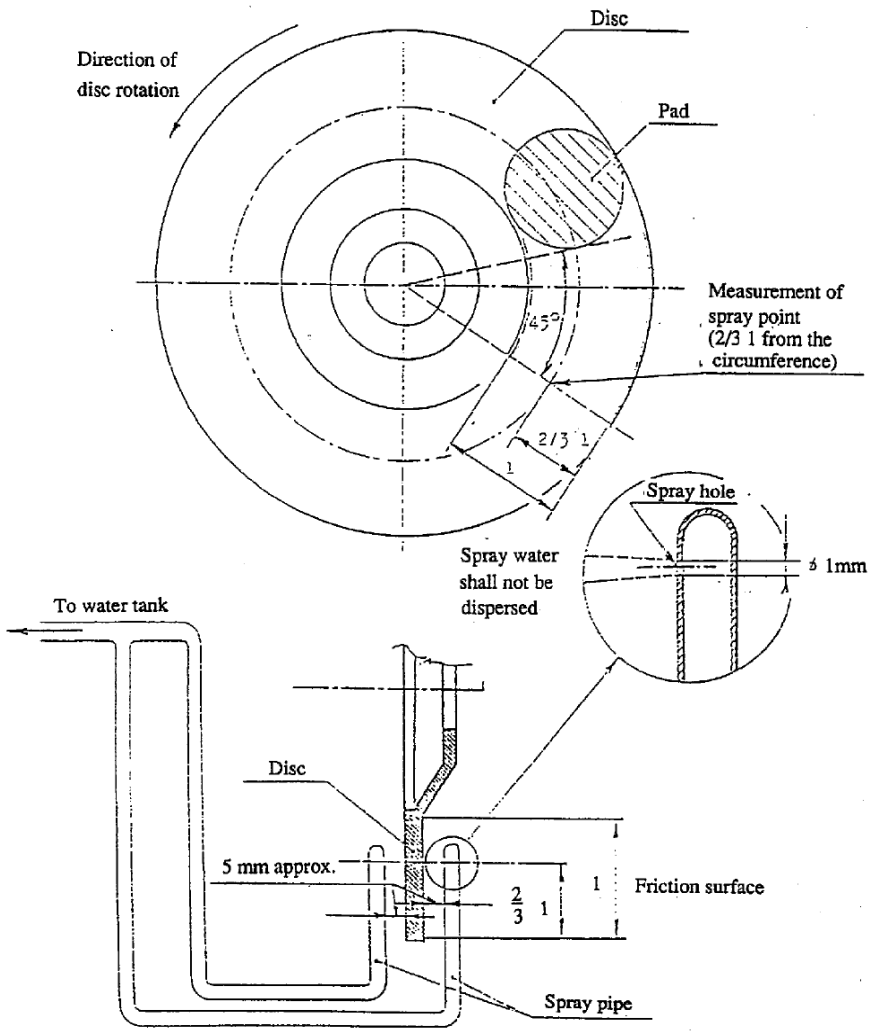

Diagram 5. Illustration of Damp Brake Spraying Device