43-1 Anti-lock braking system (ABS)：Effective date from 2013/1/1

Refer to: R13 10-R5/C3, R13H 00-S3, R78 03-S1

43-1.1 Effective date and Scope:

43-1.1.1 Effective date from 2013/1/1, the new variants of O3, O4 vehicles and M2, M3, N2, N3 vehicles with not more than four axles, if it's equipped with anti-lock braking system（ABS）that shall be comply with this regulation.

43-1.1.2 Effective date from 2015/1/1, all variants of O4 vehicles, which were confirmed with "43 Anti-lock braking system (ABS)" of "Directions", shall also comply with paragraph 42-1.4.2.

43-1.1.3 Effective date from 2013/1/1,the new variants of M1, N1, L1, L3, L5 vehicles and M2, M3, N2 and N3 vehicles with more than four axles, , if it's equipped with anti-lock braking system（ABS）that shall be comply with this regulation.

43-1.1.4 Effective date from 2015/1/1, all variants of M2, M3, N2, and N3 vehicles with more than four axles, which were confirmed to "43 Anti-lock braking system (ABS)" of "Directions" and equipped with integrated endurance braking system that also shall comply with paragraph 43-1.5.1.5.

43-1.1.5 This regulation doesn't apply to the following:

43-1.1.5.1 Vehicles with a design speed not exceeding 25 km/hr.

43-1.1.5.2 The trailers which may not be coupled to power-driven vehicles with a design speed exceeding 25 km/hr.

43-1.1.6 The same applicant applying for low volume safety approval and the amounts of vehicle not exceed 3 at same year and the category symbols M1, L3 or L5 of same variant and specification, could exempt from regulation of "anti-lock braking system (ABS)".

43-1.1.7 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 "anti-lock braking system (ABS)".

43-1.1.8 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 of category symbols M1 or N1, or category symbols N2, N3, Class III or Class IV imported by organization and school could exempt from confirm a failure in the anti-lock braking system, energy consumption, utilization of adhesion and braking rate conditions of stability test on the left and right wheel.

43-1.2 Definitions:

43-1.2.1 Vehicles of category symbols M, N and O

43-1.2.1.1 Anti-lock brake system, ABS: is a part of a service braking system which automatically controls the degree of slip, in the direction of rotation of the wheel(s) on one or more wheels of the vehicle during braking.

43-1.2.2 Vehicles of category symbols L1, L3 and L5

43-1.2.2.1 "Antilock brake system (ABS)" means a system which senses wheel slip and automatically modulates the pressure producing the braking forces at the wheel(s) to limit the degree of wheel slip.

43-1.2.3 Sensor: means a component designed to identify and transmit to the controller the conditions of rotation of the wheel(s) or the dynamic conditions of the vehicle.

43-1.2.4 Controller: means a component designed to evaluate the data transmitted by the sensor(s) and to transmit a signal to the modulator.

43-1.2.5 Modulator: means a component designed to vary the braking force(s) in accordance with the signal received from the controller.

43-1.2.6 Directly controlled wheel: means a wheel whose braking force is modulated according to data provided at least by its own sensor.
43-1.2.7 Indirectly controlled wheel: means a wheel whose braking force is modulated according to data provided by the sensor(s) of other wheel(s).
43-1.2.8 Full cycling: means that the anti-lock brake system is repeatedly modulating the brake force to prevent the directly controlled wheels from locking. Brake applications where modulation only occurs once during the stop shall not be considered to meet this definition.
43-1.2.9 Coefficient of adhesion: means the quotient of the maximum braking forces without locking the wheels and the corresponding dynamic load on the axle being braked.
43-1.2.10 Utilization of adhesion: is defined as the quotient of the maximum braking rate with the anti-lock brake system operative (zAL) and the coefficient of adhesion (kM).
43-1.2.11 Full Force: means the maximum force applied on the control device for the category of vehicle.
43-1.2.12 "Laden vehicle" means, except where otherwise stated, a vehicle so laden as to attain its "maximum mass".
43-1.2.13 Lightly loaded: means mass in running order plus 15 kg for test equipment, or the laden condition, whichever is less. In the case of ABS tests on a low friction surface, the mass for test equipment is increased to 30 kg to account for outriggers.
43-1.2.14 "Maximum mass" means the maximum mass stated by the vehicle manufacturer to be technically permissible (this mass may be higher than the "permissible maximum mass" laid down by the national administration).
43-1.2.15 "Combined braking system" means in the case of vehicles of categories L1, L3, a system whereby at least two brakes on different wheels are actuated in combination by the operation of a single control. In the case of vehicles of categories L2 and L5, a service brake system where the brakes on all wheels are operated by the actuation of a single control.
43-1.2.16 "Unladen vehicle mass" means in the case of vehicles of categories L the nominal mass of the vehicle as indicated by the manufacturer(s) including all factory fitted equipment for normal operation of that vehicle (e.g. fire extinguisher, tools, spare wheel), plus coolant, oils, 90 per cent of fuel and 100 per cent of other gas or liquids, as specified by the manufacturer.

43-1.3 Anti-lock braking system (ABS) shall according to suitable variants and range of principle are as below：
43-1.3.1 The same vehicle category symbol.
43-1.3.2 The same axle set variant.
43-1.3.3 The same brand and vehicle type.
43-1.3.4 The chassis vehicle have had same axle set variant.
43-1.3.5 The same chassis brand.
43-1.3.6 Chassis manufacturers announced that the same chassis vehicle type.
43-1.3.7 If use chassis vehicle instead of completed vehicle for testing, which shall according to suitable variants and range of principle are as below：
43-1.3.7.1 The chassis vehicle have had same axle set variant.
43-1.3.7.2 The same brand.
43-1.3.7.3 Chassis manufacturers announced that the same chassis vehicle type.
43-1.3.8 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：

43-1.3.8.1 The same vehicle category symbol.
43-1.3.8.2 The combined braking have had same axle set variant.
43-1.3.8.3 The same combined braking brand.
43-1.3.8.4 The same combined braking type.
43-1.3.8.5 The same brand of anti-lock system control unit.
43-1.3.8.6 The same type of anti-lock system control unit.

43-1.4 Types of Anti-lock Braking System (ABS):

43-1.4.1 A power-driven vehicle is deemed to be equipped with an anti-lock braking system, if one of the following systems is fitted:

43-1.4.1.1 Category 1 anti-lock braking system: A vehicle equipped with a category 1 anti-lock braking system shall meet all the relevant requirements in paragraph 43-1.5.1 and 43-1.9.1of this Regulation.

43-1.4.1.2 Category 2 anti-lock braking system: A vehicle equipped with a category 2 anti-lock braking system shall meet all the relevant requirements in paragraph 43-1.5.1 and 43-1.9.1 of this Regulation, except those of paragraph 43-1.6.3.5.2.

43-1.4.1.3 Category 3 anti-lock braking system: A vehicle equipped with a category 3 anti-lock braking system shall meet all the relevant requirements in paragraph 43-1.5.1 and 43-1.9.1 of this Regulation, except those of paragraphs 43-1.6.3.5.1 and 43-1.6.3.5.2.

43-1.4.2 Trailers of category O3 shall be equipped with an anti-lock braking system which meet one of the following conditions. Trailers of category O4 shall be equipped with an anti-lock braking system in accordance with the category A requirements in the following.

43-1.4.2.1 Category A anti-lock braking system: A trailer equipped with a category A anti-lock braking system shall meet all the relevant requirements in paragraph 43-1.5.1 and 43-1.9.2 of this Regulation.

43-1.4.2.2 Category B anti-lock braking system: A trailer equipped with a category B anti-lock braking system shall meet all the relevant requirements in paragraph 43-1.5.1 and 43-1.9.2 of this Regulation, except paragraph 43-1.7.3.2.

43-1.4.3 L1 and L3 motorcycles equipped with anti-lock braking system shall meet all the relevant requirements in paragraph 43-1.8. of this Regulation.

43-1.5 General Requirements

43-1.5.1 Vehicles of category symbols M, N and O (Motor vehicle and trailer)

43-1.5.1.1 Any electrical failure or sensor anomaly that affects the system with respect to the functional and performance requirements, including those in the supply of electricity, the external wiring to the controller(s), the controller(s) and the modulator(s) shall be signalled to the driver by a specific optical warning signal. The yellow warning signal specified shall be used for this purpose.

43-1.5.1.1.1 Sensor anomalies, which cannot be detected under static conditions, shall be detected not later than when the vehicle speed exceed 10 km/h. However, to prevent erroneous fault indication when a sensor is not generating a vehicle speed output, due to non-rotation of a wheel, verification may be delayed but detected not later than when the vehicle speed exceeds 15 km/hr.

43-1.5.1.1.2 When the anti-lock braking system is energized with the vehicle stationary, electrically controlled pneumatic modulator valve(s) shall cycle at least once.

43-1.5.1.2 Power-driven vehicles equipped with an anti-lock braking system and authorized to tow a trailer equipped with such a system, with the exception of vehicles of categories M1 and N1, shall be fitted with a separate optical warning signal for the

anti-lock braking system of the trailer, meeting the requirements of paragraph 43-1.5.1. The separate yellow warning signals specified shall be used for this purpose, activated via pin 5 of the electrical connector conforming to ISO 7638:1997, for all load conditions, a braking rate shall be developed between a pressure of 20 and 100 kPa or equivalent digital demand value at the coupling head of the control line(s).

43-1.5.1.3 In the event of a failure in the anti-lock braking system of category symbols M1（result from one electrical function failure and illuminates the yellow warning lamps），its service braking shall be at least 80 percent of the braking performance in the mode 0 （neutral gear）. In the case of trailers the residual braking performance in the event of a defect in the anti-lock braking system according to paragraph 43.5.1.1 shall be at least 80 percent of the prescribed laden performance for the service braking system of the relevant trailer. When anti-lock braking system of other vehicle is in failure, residual braking performance shall be reach part of braking system functions while the transmission of the service braking system is failed have to meet the requirement. This requirement shall not be construed as a departure from the requirements concerning secondary braking.

43-1.5.1.4 The operation of the anti-lock braking system shall not be adversely affected by magnetic or electrical fields.

43-1.5.1.5 A manual device may not be provided to disconnect or change the control mode of the anti-lock braking system, except on off-road power-driven vehicles of categories N2G and N3G.

43-1.5.1.6 Vehicles equipped with an integrated endurance braking system must also be equipped with an anti-lock braking system acting at least on the service brakes of the endurance braking system's controlled axle and on the endurance braking system itself.

43-1.6 Tests for the Anti-lock braking system fitted to power-driven vehicles

43-1.6.1 Energy-consumption

43-1.6.1.1 Test procedure

43-1.6.1.1.1 The initial energy level in the energy storage device(s) shall be that specified by the manufacturer. This level shall be at least such as to ensure the efficiency prescribed for service braking when the vehicle is laden. The energy storage device(s) for pneumatic auxiliary equipment must be isolated.

43-1.6.1.1.2 From an initial speed of not less than 50 km/h, on a surface with a coefficient of adhesion of 0.3 or less, the brakes of the laden vehicle shall be fully applied for a time t, during which time the energy consumed by the indirectly controlled wheels shall be taken into consideration and all directly controlled wheels must remain under control of the anti-lock brake system.

43-1.6.1.1.3 The vehicle's engine shall then be stopped or the supply to the energy transmission storage device(s) cut off.

43-1.6.1.1.4 The service braking control device shall then be fully actuated four times in succession with the vehicle stationary.

43-1.6.1.2 Additional requirements

43-1.6.1.2.1 The coefficient of adhesion (k) of the road surface shall be measured with the vehicle under test.

43-1.6.1.2.2 The braking test shall be conducted with the engine disconnected and idling, and with the vehicle laden.

43-1.6.1.2.3 The braking time t shall be determined by the formula:

$$t = \frac{V\,\max}{7}$$ (but not less than 15 seconds)

Where,

t = time interval (sec)

Vmax= the maximum design speed of the vehicle expressed in km/h, with an upper limit of 160 km/h.

43-1.6.1.2.4 If the time t cannot be completed in a single braking phase, further phases may be used, up to a maximum of four in all.

43-1.6.1.2.5 If the test is conducted in several phases, no fresh energy shall be supplied between the phases of the test.

43-1.6.2 Utilization of adhesion (ε)

43-1.6.2.1 The adhesion utilization ε shall be measured on road surfaces with a coefficient of adhesion of 0.3 or less, and of about 0.8 (dry road), with an initial speed of 50 km/h.

43-1.6.2.2 The utilization of adhesion by the anti-lock brake system shall be checked on complete vehicles equipped with anti-lock brake systems of categories 1 or 2. In the case of vehicles equipped with category 3 anti-lock brake systems, only the axle(s) with at least one directly controlled wheel must satisfy this requirement.

43-1.6.2.3 The condition epsilon shall be checked with the vehicle under both laden and unladen. The laden test on the high adhesion surface may be omitted if the prescribed force on the control device does not achieve full cycling of the anti-lock brake system.

43-1.6.2.4 For the unladen test, the control force may be increased up to 1000 N if no cycling is achieved with its full force value. If 1000 N is insufficient to make the system cycle, then this test may be omitted. For air braking systems the air pressure may not be increased above the cut-out pressure for the purpose of this test.

43-1.6.2.5 The utilization of adhesion $\varepsilon = \frac{Z_{AL}}{k_M}$ (The value ε shall be rounded to two decimal places.)

Where,

Z_{AL} = the maximum braking rate of the vehicle with the anti-lock brake system operative

k_M = k-factor of the power-driven vehicle

43-1.6.2.5.1 Determination of the coefficient of adhesion k

43-1.6.2.5.1.1 The brakes shall be applied on only one axle of the vehicle under test, at an initial speed of 50 km/h. The braking forces shall be distributed between the wheels of the axle to reach maximum performance. The anti-lock brake system shall be disconnected, or inoperative, between 40 km/h and 20 km/h.

43-1.6.2.5.1.2 A number of tests at increments of line pressure shall be carried out to determine the maximum braking rate of the vehicle (Z_{max}). During each test, a constant input force shall be maintained and the braking rate will be determined by reference to the time taken (t) for the speed to reduce from 40 km/h to 20 km/h using the formula: $Z = \frac{0.566}{t}$

43-1.6.2.5.1.2.1 Wheel lock may occur below 20 km/h.

43-1.6.2.5.1.2.2 Starting from the minimum measured value of t, called tmin, then select three values of t comprised within tmin and 1.05 tmin and calculate their arithmetical mean value tm, then calculate

$Z_m = \frac{0.566}{t_m}$. If it is demonstrated that for practical reasons the three values defined above cannot be obtained, then the minimum time tmin may be utilized. However, if epsilon > 1.00 the measurements of coefficients of adhesion shall be repeated. A tolerance of 10 per cent is accepted.

43-1.6.2.5.1.2.3 The braking forces shall be calculated from the measured braking rate and the rolling resistance of the unbraked axle(s), which is equal to 0.015 and 0.010 of the static axle load for a driven axle and a non-driven axle, respectively.

43-1.6.2.5.1.2.4 The value of k, kf and kr shall be rounded to three decimal places.

43-1.6.2.5.1.2.5 Then, the test will be repeated for the other axle(s) as defined in paragraphs 43-1.6.2.5.1.1 to 43-1.6.2.5.1.4 above (for exemptions see paragraphs 43-1.6.2.5.1.7 and 43-1.6.2.5.1.8 below).

43-1.6.2.5.1.2.6 One coefficient will be determined for the front axle kf and one for the rear axle kr. For example, in the case of a two-axle rear-wheel drive vehicle, with the front axle (1) being braked, the coefficient of adhesion (k) is given by:

$$k_f = \frac{Z_m \cdot P \cdot g - 0.015 \cdot F_2}{F_1 + \frac{h}{E} \cdot Z_m \cdot P \cdot g}$$

Where,

k_f = the coefficient of adhesion for front axle

Z_m = the average braking rate

P = mass of vehicle (kgf)

g = Gravity acceleration (9.81m/s2)

F_1 = front axle load

F_2 = driving axle load

h = height of center of gravity (m), specified by vehicle manufacturer and approved by the Authority

E = wheelbase (m)

43-1.6.2.5.1.2.7 For power-driven vehicles equipped with three axles, only the axle not associated with a close-coupled bogie will be used to establish a k value for the vehicle.

43-1.6.2.5.1.2.8 For vehicles of categories N2 and N3 with a wheelbase less than 3.80 m and with h/E □ 0.25 the determination of coefficient of adhesion for rear axle can be omitted.

43-1.6.2.5.2 Determination of k_M and Z_{AL}

43-1.6.2.5.2.1 From an initial vehicle speed of 55 km/h, the maximum braking rate (Z_{AL}) shall be measured with full cycling

of the anti-lock braking system and based on the average value t_m of three tests, as in 43-1.6.2.5.1.2.2 above, using the time taken for the speed to reduce from 45 km/h to 15 km/h, according to the following formula: $Z_{AL} = \frac{0.849}{t_m}$.

43-1.6.2.5.2.2 The coefficient of adhesion k_M shall be determined by weighting with the dynamic axle loads.

$$k_M = \frac{k_f \cdot F_{fdyn} + k_r \cdot F_{rdyn}}{P \cdot g}$$

Where,

$$F_{fdyn} = F_f + \frac{h}{E} \cdot Z_{AL} \cdot P \cdot g$$

$$F_{rdyn} = F_r - \frac{h}{E} \cdot Z_{AL} \cdot P \cdot g$$

And where:

F_{fdyn} = normal reaction of road surface on the front axle(s) of vehicle or full trailer under dynamic conditions with the anti-lock braking system operative (*kgf*).

F_{rdyn} = normal reaction of road surface on the rear axle(s) of vehicle or full trailer under dynamic conditions with the anti-lock braking system operative (kgf).

F_f = normal reaction of road surface on the front axle(s) under static conditions (kgf)

F_r = normal reaction of road surface on the rear axle(s) under static conditions (*kgf*)

43-1.6.2.5.2.3 In the case of a vehicle equipped with an anti-lock brake system of categories 1 or 2, the value of ZAL will be based on the whole vehicle, with the anti-lock brake system operative.

43-1.6.2.5.2.4 In the case of a vehicle equipped with an anti-lock brake system of category 3, the value of ZAL will be measured on each axle, which has at least one directly controlled wheel. For example, for a two-axle rear-wheel drive vehicle with an anti-lock brake system acting only on the rear axle, the adhesion utilized is given by:

$$\varepsilon_2 = \frac{Z_{AL} \cdot P \cdot g - 0.010 \cdot F_1}{k_2 (F_2 - \frac{h}{E} \cdot Z_{AL} \cdot P \cdot g)}$$

43-1.6.3 Additional checks

43-1.6.3.1 The following additional checks shall be carried out, engine disconnected, with the vehicle laden and unladen.

43-1.6.3.2 Low/high speed test

The wheels directly controlled by an anti-lock braking system must not lock when the full force is suddenly applied on the

control device, on the road surfaces specified in paragraph 43-1.6.2.1, at an initial speed of 40 km/h and at a high initial speed as indicated on the Table 3 below:

Table 3

	Vehicle category symbol	Maximum test speed
High adhesion surface	All except N2, N3 laden	$0.8V_{max}$□120 km/hr
	N2, N3 laden	$0.8V_{max}$□80 km/hr
Low adhesion surface	M_1, N_1	$0.8V_{max}$□120 km/hr
	M2, M3, N2 except tractors for semi-trailers	$0.8V_{max}$□80 km/hr
	N3 and N2 tractors for semi-trailers	$0.8V_{max}$□70 km/hr

43-1.6.3.3 High-adhesion surface to low-adhesion surface test

When an axle passes from a high-adhesion surface (k_H) to a low adhesion surface (k_L) where k_H □ 0.5 and k_H / k_L □ 2, with the full force applied on the control device, the directly controlled wheels must not lock. The running speed and the instant of applying the brakes shall be so calculated that, with the anti-lock brake system fully cycling on the high-adhesion surface, the passage from one surface to the other is made at high and at low speed, under the conditions laid down in paragraph 43-1.6.3.2 above.

43-1.6.3.4 Low-adhesion surface to high-adhesion surface test

When a vehicle passes from a low-adhesion surface (k_L) to a high-adhesion surface (k_H) where k_H □ 0.5 and k_H / k_L □ 2, with the full force applied on the control device, the deceleration of the vehicle must rise to the appropriate high value within a reasonable time and the vehicle must not deviate from its initial course. The running speed and the instant of applying the brakes shall be so calculated that, with the anti-lock brake system fully cycling on the low-adhesion surface, the passage from one surface to the other occurs at approximately 50 km/h.

43-1.6.3.5 Stability test on the left and right wheel

43-1.6.3.5.1 In the case of vehicles equipped with anti-lock brake systems of categories 1 or 2, when the right and left wheels of the vehicle are situated on surfaces with differing coefficients of adhesion (kH and kL), where kH □ 0.5 and kH/kL □ 2, the full force is suddenly applied on the control device at a speed of 50 km/h.

43-1.6.3.5.2 Furthermore, laden vehicles equipped with anti-lock brake systems of category 1 shall, under the conditions of 43-1.6.2.5.3.5.1 satisfy the braking rate:

$$Z_{MALS} \geq 0.75\frac{4k_L + k_H}{5} \text{ and } Z_{MALS} \geq k_L$$

Where,

Z_{MALS} = Z_{AL} of the power-driven vehicle on a "split surface"

k_L = k-value determined on the low-adhesion surface

k_H = k-value determined on the high-adhesion surface

43-1.7 Tests for the anti-lock brake system fitted to trailers

43-1.7.1 Energy consumption

43-1.7.1.1 Compliance with the requirement shall be checked by the procedure specified below, with the vehicle unladen, on a straight and level road with a surface having a good coefficient of adhesion and with the brakes adjusted as closely as possible and with the proportioning/load-sensing valve (if fitted) held in the "laden" position throughout the test. If the coefficient of adhesion of the test track is too high, preventing the anti-lock brake system from full cycling, then the test may be carried out on a surface with a lower coefficient of adhesion.

43-1.7.1.2 In the case of compressed-air braking systems, the initial energy level in the energy transmission storage device(s) shall be equivalent to a pressure of 8.0 bar at the coupling head of the trailer's supply line.

43-1.7.1.3 With an initial vehicle speed of at least 30 km/h the brakes shall be fully applied for a time t = 15 s, during which all wheels must remain under control of the anti-lock brake system. During this test, the supply to the energy transmission storage device(s) shall be cut off. If the time t = 15 s cannot be completed in a single braking phase, further phases may be used. During these phases no fresh energy shall be supplied to the energy transmission storage device(s) and, as from the second phase, the additional energy consumption for filling the actuators is to be taken into account.

43-1.7.1.4 At the end of the braking, with the vehicle stationary, the service braking control device shall be fully actuated four times.

43-1.7.2 Utilization of adhesion (ε)

43-1.7.2.1 The condition epsilon shall be verified with the vehicle unladen, on a straight and level road with a surface having a good coefficient of adhesion. If the coefficient of adhesion of the test track is too high, preventing the anti-lock brake system from full cycling, then the test may be carried out on a surface with a lower coefficient of adhesion. In the case of trailers equipped with a brake load sensing device, the pressure setting of the device may be increased to ensure full cycling.

43-1.7.2.2 To eliminate the effects of differential brake temperatures, it is recommended to determine ZRAL prior to the determination of kR.

43-1.7.2.3 The utilization of adhesion $\varepsilon = \frac{Z_{RAL}}{k_R}$ （The value ε shall be rounded to two decimal places）

Where,

Z_{RAL} = Z_{AL} of the trailer obtained by braking all the axles, the towing vehicle unbraked and its engine disengaged.

k_R = k-factor of the trailer

43-1.7.2.3.1 Determination of the coefficient of adhesion (k)

43-1.7.2.3.1.1 The brakes shall be applied on only one axle of the vehicle under test, at an initial speed of 50 km/h. The braking forces shall be distributed between the wheels of the axle to reach maximum performance. The anti-lock system shall be disconnected, or inoperative, between 40 km/h and 20 km/h.

43-1.7.2.3.1.2 A number of tests at increments of line pressure shall be carried out to determine the maximum braking rate

of the vehicle (Z_{max}). During each test, a constant input force shall be maintained and the braking rate will be determined by reference to the time taken (t) for the speed to reduce from 40 km/h to 20 km/h using the formula: $Z_C = \frac{0.566}{t}$

43-1.7.2.3.1.2.1 Wheel lock may occur below 20 km/h.

43-1.7.2.3.1.2.2 Starting from the minimum measured value of t, called t_{min}, then select three values of t comprised within t_{min} and 1.05 t_{min} and calculate their arithmetical mean value t_m, then calculate $Z_{C\max} = \frac{0.566}{t_m}$.

If it is demonstrated that for practical reasons the three values defined above cannot be obtained, then the minimum time t_{min} may be utilized.

43-1.7.2.3.1.3 Full trailers.

43-1.7.2.3.1.3.1 The measurement of k (with the anti-lock braking system being disconnected, or inoperative, between 40 km/h and 20 km/h) will be performed for the front and the rear axles.

For one front axle i:

$$F_{bR\max i} = Z_{C\max i} \cdot (F_M + F_R) - 0.01F_{Cnd} - 0.015F_{Cd}$$

$$F_{idyn} = F_i + \frac{Z_{C\max}(F_M \cdot h_D + g \cdot P \cdot h_R) - F_{WM} \cdot h_D}{E}$$

$$k_f = \frac{F_{bR\max i}}{F_{idyn}}$$

Where,

$F_{bR\max i}$ = maximum value of braking force($F_{bR\max}$) of the trailer with only axle i of the trailer braked and the anti-lock braking system inoperative

$Z_{C\max i}$ = maximum braking rate ($Z_{C\max}$) while merely axle i is braked and trailer's anti-lock brake system is inoperative.

F_{Cnd} = total normal reaction of road surface on the unbraked and non-driven axles of the vehicle combination under static conditions (kgf)

F_{Cd} = total normal reaction of road surface on the unbraked and driven axles of the vehicle combination under static conditions (kgf)

F_M = total normal static reaction of road surface on all wheels of power-driven (towing) vehicle (kgf)

F_R = total normal static reaction of road surface on all wheels of trailer (kgf)

F_{WM} = $0.01\cdot$ (total normal static reaction of road surface on the unbraked and non-driven axles of the power-driven vehicle $F_{M\,nd}$) + $0.015\cdot$ (total normal static reaction of road surface on the unbraked and driven axles of the power-driven vehicle $F_{M\,d}$)

h_D = height of drawbar (hinge point on trailer) (m)

h_R = height of centre of gravity of the trailer (m)

43-1.7.2.3.1.3.2 For one rear axle i:

$$F_{bR\max i} = Z_{C\max i}\cdot(F_M + F_R) - 0.01F_{Cnd} - 0.015F_{Cd}$$

$$F_{idyn} = F_l + \frac{Z_{C\max}(F_M\cdot h_D + g\cdot P\cdot h_R) - F_{WM}\cdot h_D}{E}$$

$$k_r = \frac{F_{bR\max i}}{F_{idyn}}$$

Where,

$F_{i\,dyn}$ = normal reaction (F_{dyn}) of road surface under dynamic conditions with the anti-lock braking system operative on axle i in case of power-driven vehicles or full trailers

k_r = k-factor of one rear axle

43-1.7.2.3.1.3.3 The coefficient of adhesion k_R shall be determined proportionally according to the dynamic axle loads.

$$k_R = \frac{k_f\cdot F_{fdyn} + k_r\cdot F_{rdyn}}{P\cdot g}$$

Where,

k_f = k-factor of one front axle

k_r = k-factor of one rear axle

43-1.7.2.3.1.3.4 Semi-trailers and centre-axle trailers

The measurement of k (that is k_R)shall be carried out with wheels fitted only on one axle, the wheels of the other axle(s) are removed.

$$F_{bR\max} = Z_{C\max} * (F_M + F_R) - F_{WM}$$

$$F_{Rdyn} = F_R - \frac{F_{bR\max} * h_k + Z_C * g * P(h_R - h_k)}{E_R}$$

$$k = \frac{F_{bR\max}}{F_{Rdyn}}$$

Where,

$F_{bR\max}$ = maximum value of braking force (FbR)of the trailer with the anti-lock braking system inoperative (kgf)

F_{Rdyn} = normal reaction of road surface under dynamic conditions on the axle(s) of semi-trailer or centre-axle trailer with the anti-lock braking system operative (kgf)

h_k = height of fifth wheel coupling (king pin) (m)

E_R = distance between king-pin and centre of axle or axles of semi-trailer (or distance between drawbar coupling and centre of axle or axles of centre-axle trailer) (m)

43-1.7.2.3.2 Determination of Z_{RAL}: Z_{RAL} is to be decided on the surface having high efficient of adhesion; yet, for the vehicles equipped with category A anti-lock braking system, it rather to be decided on the surface having low efficient of adhesion.

43-1.7.2.3.2.1 Full trailer

With the anti-lock braking system operative:

$$Z_{RAL} = \frac{Z_{CAL} * (F_M * F_R) - 0.01F_{Cnd} - 0.015F_{Cd}}{F_R}$$

Where,

Z_{CAL} = braking rate z of the vehicle combination, with the trailer only braked and the anti-lock system operative

43-1.7.2.3.2.2 Semi-trailer and centre-axle trailer

The measurement of ZRAL (with the anti-lock braking system operative) shall be carried out with all wheels fitted.

$$Z_{RAL} = \frac{F_{b\,RAL}}{F_{Rdyn}}$$

In the above equation

$$F_{bR\,AL} = Z_{CAL} * (F_M + F_R) - F_{WM}$$

$$F_{Rdyn} = F_R - \frac{F_{bRAL} * h_k + Z_C * g * P(h_R - h_k)}{E_R}$$

Where,

F_{bRAL} = braking force of the trailer with the anti-lock system operative (kgf)

Z_C = braking rate z of the vehicle combination, with the trailer only braked and the anti-lock system inoperative

43-1.7.2.3.2.3 The maximum braking rate (Z_{Cmax}) shall be measured with full cycling of the anti-lock braking system and the towing vehicle unbraked, based on the average value of three tests, as in paragraph 43-1.7.2.3.1.2 of this regulation.

43-1.7.3 Additional checks

43-1.7.3.1 Low/high speed test:

This shall be checked, under the conditions prescribed in paragraph 43-1.7.2.1, at initial speeds of 40 km/h and 80 km/h.

43-1.7.3.2 Stability test on the left and right wheels:

The provisions of this paragraph shall only apply to trailers equipped with an anti-lock braking system of category A. When the right and left wheels are situated on surfaces which produce differing maximum braking rates (z_{RALH} and z_{RALL}), where $\frac{Z_{RALH}}{\varepsilon_H} \geq 0.5$ and $\frac{Z_{RALH}}{Z_{RALL}} \geq 2$, the full force 1/ is suddenly applied on the control device of the towing vehicle at a speed of 50 km/h. Under this condition, the unladen vehicle shall satisfy $Z_{RALS} \geq \frac{0.75}{\varepsilon_H}\frac{4Z_{RALL}+Z_{RALH}}{5}$ and $Z_{RALS} > \frac{Z_{RALL}}{\varepsilon_H}$. And in the case of trailers equipped with a brake load sensing device, the pressure setting of the device may be increased to ensure full cycling. The ratio of Z_{RALH}/Z_{RALL} may be ascertained by test or by calculating.

43-1.8 Tests and standard for the anti-lock brake system fitted to motorcycles

43-1.8.1 General:

43-1.8.1.1 The tests are only applicable to the ABS fitted on vehicle categories L1 and L3;

43-1.8.1.2 The tests are to confirm the performance of brake systems equipped with ABS and their performance in the event of ABS electrical failure;

43-1.8.1.3 Wheel-lock is allowed as long as the stability of the vehicle is not affected to the extent that it requires the operator to release the control or causes a vehicle wheel to pass outside the test lane. The test series comprises the following individual tests, which may be carried out in any order:

43-1.8.1.4 Ambient temperature: The ambient temperature is between 4 degrees C and 45 degrees C.

43-1.8.1.5 Wind speed: The wind speed is not more than 5 m/s.

43-1.8.1.6 Test speed tolerance：The test speed tolerance is +/- 5 km/h. In the event of the actual test speed deviating from the specified test speed, the actual stopping distance is corrected using the formula in paragraph 43-1 8.3.1.1. of this Regulation.

ABS TESTS
a. Stops on a high friction surface

b. Stops on a low friction surface
c. Wheel lock checks on high and low friction surfaces
d. Wheel lock check - high to low friction surface transition
e. Wheel lock check - low to high friction surface transition
f. Stops with an ABS electrical failure

43-1.8.2 Vehicle condition:

43-1.8.2.1 Lightly loaded;

43-1.8.2.2 Engine disconnected.

43-1.8.2.3 Stops on a high friction surface:

43-1.8.2.3.1 Test conditions and procedure:

43-1.8.2.3.1.1 Initial brake temperature: ≧ 55 degrees C and ≦ 100 degrees C;

43-1.8.2.3.1.2 Test speed: 60 km/h or 0.9 Vmax, whichever is lower;

43-1.8.2.3.1.3 Brake application:

Simultaneous actuation of both service brake system controls, if so equipped, or of the single service brake control in the case of a service brake system that operates on all wheels;

43-1.8.2.3.1.4 Brake actuation force:

The force applied is that which is necessary to ensure that the ABS will cycle fully throughout each stop, down to 10 km/h;

43-1.8.2.3.1.5 If one wheel is not equipped with ABS, the control for the service brake on that wheel shall be actuated with a force that is lower than the force that will cause the wheel to lock;

43-1.8.2.3.1.6 Number of stops: until the vehicle meets the performance requirements, with a maximum of 6 stops;

43-1.8.2.3.1.7 For each stop, accelerate the vehicle to the test speed and then actuate the brake control under the conditions specified in this paragraph;

43-1.8.2.3.2 Performance requirements

When the brakes are tested in accordance with the test procedures:

43-1.8.2.3.2.1 The stopping distance (S) shall be ≦ $0.0063V^2$ (where V is the specified test speed in km/h and S is the required stopping distance in metres) or the MFDD shall be ≧ 6.17 m/s^2; and

43-1.8.2.3.2.2 There shall be no wheel lock and the vehicle wheels shall stay within the test lane.

43-1.8.2.4 Stops on a low friction surface:

43-1.8.2.4.1 Test conditions and procedure:

As set out in paragraph 43-1.8.2.3.1., but using the low friction surface instead of the high friction one;

43-1.8.2.4.1.1 Applicable to all dynamic brake tests where a low-friction surface is specified;

43-1.8.2.4.1.2 The test area is a clean and level surface, with a gradient □ 1 per cent;

43-1.8.2.4.1.3 The surface has a PBC of □ 0.45.

43-1.8.2.4.2 Performance requirements

When the brakes are tested in accordance with the test procedures:

43-1.8.2.4.2.1 The stopping distance (S) shall be ≦ $0.0056V^2/P$ (where V is the specified test speed in km/h, P is the peak

braking coefficient and S is the required stopping distance in metres) or the MFDD shall be ≧ 6.87 x P, in m/s^2; and

43-1.8.2.4.2.2 There shall be no wheel lock and the vehicle wheels shall stay within the test lane.

43-1.8.2.5 Wheel lock checks on high and low friction surfaces:

43-1.8.2.5.1 Test conditions and procedure:

43-1.8.2.5.1.1 Test surfaces:

43-1 8.2.5.1.1.1 High friction; and

43-1 8.2.5.1.1.2 Low friction;

43-1.8.2.5.1.2 Initial brake temperature: ≧ 55 degrees C and ≦ 100 degrees C;

43-1.8.2.5.1.3 Test speed:

43-1 8.2.5.1.3.1 On the high friction surface: 80 km/h or 0.8 Vmax, whichever is lower;

43-1 8.2.5.1.3.2 On the low friction surface: 60 km/h or 0.8 Vmax, whichever is lower;

43-1.8.2.5.1.4 Brake application:

43-1 8.2.5.1.4.1 Each service brake system control actuated separately;

43-1 8.2.5.1.4.2 Where ABS is fitted to both brake systems, simultaneous actuation of both brake controls in addition to (i);

43-1.8.2.5.1.5 Brake actuation force:

The force applied is that which is necessary to ensure that the ABS will cycle fully throughout each stop, down to 10 km/h;

43-1.8.2.5.1.6 Brake application rate:

The brake control actuation force is applied in 0.2 - 0.5 seconds;

43-1.8.2.5.1.7 Number of stops: until the vehicle meets the performance requirements, with a maximum of 3 stops;

43-1.8.2.5.1.8 For each stop, accelerate the vehicle to the test speed and then actuate the brake control under the conditions specified in this paragraph;

43-1.8.2.5.2 Performance requirements:

When the brakes are tested in accordance with the test procedures, there shall be no wheel lock and the vehicle wheels shall stay within the test lane.

43-1.8.2.6 Wheel lock check - high to low friction surface transition:

43-1.8.2.6.1 Test conditions and procedure:

43-1.8.2.6.1.1 Test surfaces:

A high friction surface immediately followed by a low friction surface;

43-1.8.2.6.1.2 Initial brake temperature: ≧ 55 degrees C and ≦ 100 degrees C;

43-1.8.2.6.1.3 Test speed:

The speed that will result in 50 km/h or 0.5V max, whichever is lower, at the point where the vehicle passes from the high friction to the low friction surface;

43-1.8.2.6.1.4 Brake application:

43-1 8.2.6.1.4.1 Each service brake system control actuated separately;

43-1 8.2.6.1.4.2 Where ABS is fitted to both brake systems, simultaneous actuation of both brake controls in addition to (i);

43-1.8.2.6.1.5 Brake actuation force:

The force applied is that which is necessary to ensure that the ABS will cycle fully throughout each stop, down

to 10 km/h;

43-1.8.2.6.1.6 Number of stops: until the vehicle meets the performance requirements, with a maximum of 3 stops;

43-1.8.2.6.1.7 For each stop, accelerate the vehicle to the test speed and then actuate the brake

43-1.8.2.6.2 Performance requirements:

When the brakes are tested in accordance with the test procedures set out in paragraph 8.2.6.1., there shall be no wheel lock and the vehicle wheels shall stay within the test lane.

43-1.8.2.7 Wheel lock check - low to high friction surface transition:

43-1.8.2.7.1 Test conditions and procedure:

43-1.8.2.7.1.1 Test surfaces:

A low friction surface immediately followed by a high friction surface with a PBC ≧ 0.8;

43-1.8.2.7.1.2 Initial brake temperature: ≧ 55 degrees C and ≦ 100 degrees C;

43-1.8.2.7.1.3 Test speed:

The speed that will result in 50 km/h or 0.5 Vmax, whichever is lower, at the point where the vehicle passes from the low friction to the high friction surface;

43-1.8.2.7.1.4 Brake application:

43-1 8.2.7.1.4.1 Each service brake system control applied separately;

43-1 8.2.7.1.4.2 Where ABS is fitted to both brake systems, simultaneous application of both brake controls in addition to (i);

43-1.8.2.7.1.5 Brake actuation force:

The force applied is that which is necessary to ensure that the ABS will cycle fully throughout each stop, down to 10 km/h;

43-1.8.2.7.1.6 Number of stops: until the vehicle meets the performance requirements, with a maximum of 3 stops;

43-1.8.2.7.1.7 For each stop, accelerate the vehicle to the test speed and then actuate the brake control before the vehicle reaches the transition from one friction surface to the other;

43-1.8.2.7.1.8 Record the vehicle's continuous deceleration;

43-1.8.2.7.2 Performance requirements:

43-1.8.2.7.2.1 When the brakes are tested in accordance with the test procedures, there shall be no wheel lock and the vehicle wheels shall stay within the test lane;

43-1.8.2.7.2.2 Within 1 second of the rear wheel passing the transition point between the low and high friction surfaces, the vehicle deceleration shall increase.

43-1.8.2.8 Stops with an ABS electrical failure:

43-1.8.2.8.1 Test conditions and procedure:

43-1.8.2.8.1.1 With the ABS electrical system disabled, carry out the test set out in “42-2 Dynamic Braking” of the Directions. (dry stop test - single brake control actuated) applying the conditions relevant to the brake system and vehicle being tested;

43-1.8.2.8.2 Performance requirements:

When the brakes are tested in accordance with the test procedure:

43-1.8.2.8.2.1 System shall satisfy the following requirements:

Vehicles that are equipped with an ABS system shall be fitted with a yellow warning lamp. The lamp shall be activated whenever there is a malfunction that affects the generation or transmission of signals in the vehicle's ABS system.

To permit function checking, the warning lamp shall be illuminated by the activation of the ignition switch and extinguished when the check has been completed.

The warning lamp shall remain on while a failure condition exists whenever the ignition switch is in the "on" position.

43-1.8.2.8.2.2 The minimum requirements for stopping distance or MFDD shall be as specified in column 2 or 3, respectively, under the heading "Single brake system, rear wheel(s) braking only" in the table to paragraph 42-2 7.7.3. of the Directions.

43-1.8.3 Measurement of dynamic performance

43-1.8.3.1 The method used to measure performance is as specified in the respective tests: There are three ways in which the service brake system performance may be measured.

43-1.8.3.1.1 MFDD (Mean Fully Developed Deceleration)：

Calculation of MFDD:

$$d_m = \frac{V_b^2 - V_e^2}{25.92 \cdot (S_e - S_b)} \quad \text{in m/s}^2$$

where:

dm = mean fully developed deceleration

V1 = vehicle speed when rider actuates the control

Vb = vehicle speed at 0.8 V1 in km/h

Ve = vehicle speed at 0.1 V1 in km/h

Sb = distance travelled between V1 and Vb in metres

Se = distance travelled between V1 and Ve in metres

43-1.8.3.1.2 Stopping distance:

Based on the basic equations of motion:

$$S = 0.1 \cdot V + (X) \cdot V^2$$

where:

S = stopping distance in metres

V = vehicle speed in km/h

X = a variable based on the requirement for each test

To calculate the corrected stopping distance using the actual vehicle test speed, the following formula is used:

$$Ss = 0.1 \cdot Vs + (Sa - 0.1 \cdot Va) \cdot Vs^2/Va^2$$

where:

Ss = corrected stopping distance in metres
Vs = specified vehicle test speed in km/h
Sa = actual stopping distance in metres
Va = actual vehicle test speed in km/h
Note: This equation is only valid when the actual test speed (Va) is within +/- 5 km/h of the specified test speed (Vs).

43-1.8.3.1.3 Continuous deceleration recording: For the burnishing procedure and tests such as the wet brake and heat fade – heating procedure, there is a continuous recording of the vehicle's instantaneous deceleration from the moment a force is applied to the brake control until the end of the stop.

43-1.9 Requirements:

43-1.9.1 Power-driven vehicle

43-1.9.1.1 Energy consumption

43-1.9.1.1.1 At the end of the fourth application, with the vehicle stationary, the energy level in the storage device(s) is at or above that required for secondary braking with the laden vehicle.

43-1.9.1.1.2 When the control device is applied for the fifth time, it must be possible to brake the vehicle with at least the performance prescribed for secondary braking of the laden vehicle.

43-1.9.1.1.3 During the tests, in the case of a power-driven vehicle authorized to draw a trailer equipped with a compressed-air braking system, the supply line shall be stopped and an energy storage device of 0.5 litre capacity shall be connected to the pneumatic control line. When the brakes are applied for the fifth time, as provided in paragraph 43-1.9.1.1.2 above, the energy level supplied to the pneumatic control line shall not be below half the level obtained at a full application starting with the initial energy level.

43-1.9.1.2 Utilization of adhesion (ε): the utilization of adhesion by the anti-lock brake system takes into consideration the actual increment in braking distance beyond the theoretical minimum. The anti-lock braking system shall be deemed to be satisfactory when the condition epsilon > 0.75 is satisfied. If epsilon > 1.00 the measurements of coefficients of adhesion shall be repeated. A tolerance of 10% is accepted.

43-1.9.1.3 Additional checks:

43-1.9.1.3.1 During the tests in paragraphs 43-1.6.3 of this Regulation, the wheels directly controlled by an anti-lock system must not lock when the full force is suddenly applied on the control device. However, brief periods of wheel-locking shall be allowed. Furthermore, wheel-locking is permitted when the vehicle speed is less than 15 km/h; likewise, locking of indirectly controlled wheels is permitted at any speed, but stability and steerability must not be affected.

43-1.9.1.3.2 During the tests provided in paragraphs 43-1.6.3.5 of this Regulation, steering correction is permitted, if the angular rotation of the steering control is within 120° during the initial two seconds, and not more than 240° in all. Furthermore, at the beginning of these tests the longitudinal median plane of the vehicle must pass over the boundary between the high- and low-adhesion surfaces and during these tests no part of the (outer) tyres must cross this boundary.

43-1.9.2 Trailer

43-1.9.2.1 Energy consumption: Trailers equipped with anti-lock braking systems shall be so designed that, even after the service braking control device has been fully applied for some time, the vehicle retains sufficient energy to bring it to a halt within a reasonable distance. During the fifth application, the pressure in the operating circuit must be sufficient to provide a total

braking force at the periphery of the wheels equal to not less than 22.5% of the maximum stationary wheel load and without causing an automatic application of any braking system not being under the control of the anti-lock system.

43-1.9.2.2 Utilization of Adhesion (ε): Braking systems equipped with an anti-lock system shall be deemed acceptable when the condition ε > 0.75 is satisfied. If epsilon > 1.00 the measurements of coefficients of adhesion shall be repeated. A tolerance of 10% is accepted.

43-1.9.2.3 Additional checks:

43-1.9.2.3.1 At speeds exceeding 15 km/h, the wheels directly controlled by an anti-lock system must not lock when the full force is suddenly applied on the control device of the towing vehicle.

43-1.9.2.3.2 At vehicle speeds □ 15 km/h the directly controlled wheels are permitted to lock for brief periods, but at speeds < 15 km/h any locking is permissible. Indirectly controlled wheels are permitted to lock at any speed but in all cases stability must not be affected.

43-1.9.3 Tests and standard for the anti-lock brake system fitted to vehicles category L5

43-1.9.3.1 Characteristic of braking system

43-1.9.3.1.1 Each controlled wheel must be such that it can bring at least its own device into operation.

43-1.9.3.1.2 Any break in the supply of electricity to the device and/or in the wiring external to the electronic controller(s) must be signalled to the driver by an optical warning signal, which must be visible even in daylight; it must be easy for the driver to check that it is in working order.

43-1.9.3.1.3 Anti-lock devices must maintain their performance when the brake is fully applied for the duration of any stop.

43-1.9.3.2 Utilization of adhesion : $\varepsilon > 0.70$

43-1.9.3.2.1 The coefficient of adhesion utilization epsilon shall be measured on road surfaces with a coefficient of adhesion not exceeding 0.45 and of not less than 0.8, and vehicle unladen.

43-1.9.3.2.2 Tests must be carried out with the vehicle unladen.

43-1.9.3.2.3 The utilization of the adhesion $\varepsilon = \frac{Zmax}{Zm}$.

43-1.9.3.2.3.1 Determination of the coefficient of adhesion (K)

43-1.9.3.2.3.1.1 The coefficient of adhesion shall be determined from the maximum braking rate, without wheel lock, of the vehicle with the anti-lock device(s) disconnected and braking both wheels simultaneously.

43-1.9.3.2.3.1.2 Braking tests should be carried out by applying the brakes at an initial speed of about 60 km/h (or, in the case of vehicles unable to attain 60 km/h, at a speed of about 0.9 Vmax) with the vehicle unladen (except for any necessary test instrumentation and/or safety equipment). Constant brake control forces must be used throughout the tests.

43-1.9.3.2.3.1.3 The braking rate (Z) will be determined by reference to the time taken for the speed of the vehicle to reduce from 40 km/h to 20 km/h, using the formula: $Z = \frac{0.56}{t}$ where t is measured in seconds. Alternatively, for vehicles unable to attain 50 km/h, the braking rate shall be determined by reference to the time taken for the speed of the vehicle to reduce from 0.8 Vmax to (0.8 Vmax – 20). The maximum value of Z = K.

43-1.9.3.2.3.1.4 A series of tests may he carried out up to the critical point reached immediately before the wheel(s) lock by varying both the front and the rear brake forces, in order to determine the maximum braking rate of the vehicle.

43-1.9.3.2.3.2 Determination of Zmax

43-1.9.3.2.3.2.1 The adhesion utilized is defined as the quotient of the maximum braking rate with the anti-lock device in operation (Zmax) and the maximum braking rate with the anti-lock disconnected (Zm). Separate tests must be carried out on each wheel equipped with the anti-lock device.

43-1.9.3.2.3.2.2 Zmax shall be based on the average of three tests using the time taken for the speed of the vehicle to achieve the reductions in speed specified in paragraph 43-1.9.3.2.3.1.3 above.

43-1.9.3.3 Additional checks : Where both independent braking devices are equipped with an anti-lock device the tests prescribed in paragraphs 43-1.9.3.3.1, 43-1.9.3.3.2 and 43-1.9.3.3.3 shall also be performed using both independent braking devices together whereupon the stability of the vehicle shall be maintained at all times.

43-1.9.3.3.1 High-speed test :

The full force is suddenly applied to its control device, on the two kinds of road surface specified in paragraph 43-1.9.3.2.1 above, at initial speeds up to 0.8 Vmax but not exceeding 80 km/h.

43-1.9.3.3.2 High-adhesion surface to low-adhesion surface test:：

When a wheel controlled by an anti-lock device passes from a high-adhesion surface to a low-adhesion surface as described in paragraph 43-1.9.3.2.1 above, the full force is applied to the control device. The running speed and the instant of applying the brakes shall be so calculated that, with the anti-lock device fully cycling on the high-adhesion surface, the passage from one surface to the other is made at about 0.5 Vmax not exceeding 50 km/h.

43-1.9.3.3.3 Low-adhesion surface to high-adhesion surface test：

When a vehicle passes from a low-adhesion surface to a high-adhesion surface as described in paragraph 43-1.9.3.2.1 above with the full force applied to the control device, the deceleration of the vehicle must rise to the appropriate high value within a reasonable time and the vehicle must not deviate from its initial course. The running speed and the instant of applying the brakes shall be so calculated that, with the anti-lock device fully cycling on the low-adhesion surface, the passage from one surface to the other occurs at about 0.5 Vmax not exceeding 50 km/h.

43-1.9.3.4 Additional checks :

43-1.9.3.4.1 Where both independent braking devices are equipped with an anti-lock device the tests prescribed in 9.3.3.1, 9.3.3.2 and 9.3.3.3 must also be performed using both independent braking devices together, the stability of the vehicle being maintained at all time.

43-1.9.3.4.2 periods of wheel locking or of extreme wheel slip shall be allowed provided that the stability of the vehicle is not adverelty affected. Below vehicle speeds of 10 km/h wheel locking is permitted.