Informal document No.15
(53rd GRRF, 3-7 February 2003 Agenda item 1.6)

PROPOSAL OF STRATEGY TO ESTABLISH A DRAFT GTR FOR BRAKING SYSTEMS OF PASSENGER CARS.

Transmitted by the Expert from Japan

1. Background & Fundamental Stance

Harmonization of ECE R13H and FMVSS135 needs to be achieved in order to produce a Global Technical Regulation covering brake system for passenger cars.
Earlier harmonization efforts have attempted to find the best compromise between ECE R13–06 and FMVSS105 at that time.
That work produced two regulations These are FMVSS135 of 1995 which is based on R13-H Draft and ECE R13-H of 1998 which was revised to cover additional topics in ECE R13–09. This has been further developed in later GRRF meetings.

There exist today several requirement clauses on which agreement has not been reached due to differences in philosophy and certification methods etc. For such items, in case agreement can not even eventually, be reached, alternative rulings or options will be offered but it is hoped that the number of these cases will, by discussion, be kept to a minimum.

2. Classification of Difference

	Classification of Existing Difference	(Reference) Necessary discussions to adopt agreed item ruling
P	Due to a different philosophy	To have further discussion Items agreed will be adopted in GTR
T	Due to the time difference of publishing date between two regulations	Possibility of revision is studied by U.S. and others Items discussed and the agreements will be adopted in the GTR
C	Due to the difference of self-certification. Classified as below:	
C1	FMVSS 135 needs more detail on procedure due to self-certification requirements.	If a performance requirement is practically the same it will be regarded as the same
C2	FMVSS 135 has difficulty in adopting due to the self-certification requirements.	Delete the point from the GTR
C3	Due to basic differences in certification method.	Discuss each item to attempt to find an agreement.
TE	Technical discussion issue	Discuss technical terms and requirements
O	Others Classified as below:	
O1	More detailed definition in either regulation	Discuss each item to find an agreed text.
O2	Practically equivalent	Adjust each item to reach a single agreed text.
O3	Following GRSG results for prescribing labeling and colors in the driver interface.	To adopt the results of GRSG (location and identification of hand control, tell-tales and indicators)

3.An outline of the comparison of current standards

Main differences are classified based on 2. above.

Main differences in FMVSS135 vs. R13-H	P	T	C1	C2	C3	TE	O1	O2	O3
(1) Unbraked Trailer	●								
(2) Dynamic Park Brake performance	●								
(3) ABS performance	●								
(4) MFDD	●								
(5) EMC	●								
(6) FMVSS; Without split service brake system ECE; Hydraulic Braking Systems with Stored Energy								●	
(7) Warning lamp	●								●
(8) EBS		●				●			
(9) RBS	●	●	●	●					
(10) Terminology			●				●		
(11)Testing condition description			●						
(12) Safety requirement of Complex Electronic Vehicle Control Systems		●		●					

Attachment 1

Comparison of differences between ECE R13-H and FMVSS135

Symbols
P；Due to difference of philosophy,T；Due to the time difference of publishing date between two regulations,
C1；FMVSS 135 needs more detail on procedure due to self-certification requirements,
C2；Difficulty in adopting a paragraph due to the self-certification requirement,C3；Due to basic differences in certificationmethod,
TE；Technical discussion issue、O1；More detailed definition in either regulation,O2；Practically equivalent,
O3； Following GRSG results for prescribing labeling and colors in the driver interface

ECE R13-H		FMVSS135		Classification
Paragraph	Contents	Paragraph	Contents	
2.	**DEFINITIONS.**			
2.1.	″Approval of a vehicle″ means the approval of a vehicle type with regard to braking;	-	N.A.	C3
2.2.	″Vehicle type ″ means a category of vehicles which do not differ in such essential respects as:	-	N.A.	C3
2.2.1.	the maximum mass, as defined in paragraph 2.11. below;			
2.2.2.	the distribution of mass among the axles;			
2.2.3.	the maximum design speed;			
2.2.4.	a different type of braking equipment, with more particular reference to the presence or otherwise of equipment for braking a trailer or any presence of electric braking system;			
2.2.5.	the engine type;			
2.2.6.	the number and ratios of gears;			
2.2.7.	the final drive ratios;			
2.2.8.	the tyre dimensions;			
2.3.	″Braking equipment″ means the combination of parts whose function is progressively to reduce the speed of a moving vehicle or bring it to a halt, or to keep it stationary if it is already halted; these functions are specified in paragraph 5.1.2. below. The equipment consists of the control, the transmission, and the brake proper;	-	N.A.	O1
2.4.	″Control″ means the part actuated directly by the driver to furnish to the transmission the energy required for braking or controlling it. This energy may be the muscular energy of the driver, or energy from another source controlled by the driver, or a combination of these various kinds of energy;	-	N.A.	O1
2.5.	the combination of components comprised between the control and the brake and linking them functionally. The transmission may be mechanical, hydraulic, pneumatic, electric 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 two 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″:	S4.	Electrically-actuated service brakes. Service brakes that utilize electrical energy to actuate the foundation brakes.	O1
2.5.1.	″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;	-	N.A.	O1
2.5.2.	″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;	-	N.A.	O1

ECE R13-H		FMVSS135		Classification
Paragraph	Contents	Paragraph	Contents	
2.6.	"Brake" means the part in which the forces opposing the movement of the vehicle develop. It may be a friction brake (when the forces are generated by friction between two parts of the vehicle moving relatively to one another); an electrical brake (when the forces are generated by electro-magnetic action between two parts of the vehicle moving relatively to but not in contact with one another); a fluid brake (when the forces are generated by the action of a fluid situated between two parts of the vehicle moving relatively to one another); or an engine brake (when the forces are derived from an artificial increase in the braking action, transmitted to the wheels, of the engine);	-	N.A.	O1
2.7.	"Different types of Braking Equipment" means equipment which differ in such essential respects as:	-	N.A.	O1
2.7.1.	components having different characteristics;			
2.7.2.	a component made of materials having different characteristics, or a component differing in shape or size;			
2.7.3.	a different assembly of the components.			
2.8.	"Component of the Braking Equipment" means one of the individual parts which, when assembled, constitute the braking equipment;	-	N.A.	O1
2.9.	"Progressive and Graduated braking" means braking during which, within the normal operating range of the device, and during actuation of the brakes (see paragraph 2.16. below):	-	N.A.	O1
2.9.1.	the driver can at any moment increase or decrease the braking force by acting on the control;			
2.9.2.	the braking force varies proportionally as the action on the control (monotonic function);			
2.9.3.	the braking force can be easily regulated with sufficient precision;			
2.10.	"Laden vehicle" means, except where otherwise stated, a vehicle so laden as to attain its maximum mass;	-	N.A.	O1
2.11.	"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);	-	N.A.	O1
2.12.	"The distribution of mass among the axles" means the distribution of the effect of the gravity on the mass of the vehicle and / or its contents among the axles;	-	N.A.	O1
2.13.	"Wheel / axle load" means the vertical static reaction (force) of the road surface in the contact area on the wheel / wheels of the axle;	-	N.A.	O1
2.14.	"Maximum stationary wheel / axle load" means the stationary wheel/axle load achieved under the condition of the laden vehicle;	-	N.A.	O1
2.15.	"Hydraulic braking equipment with stored energy" means a braking equipment where energy is supplied by a hydraulic fluid under pressure, stored in one or more accumulator(s) maximum value. This value shall be specified by the manufacturer;	-	N.A.	O1
2.16.	"Actuation" means both application and release of the control;	-	N.A.	O1
2.17.1.	"Electric regenerative braking control" means a device which modulates the action of the electric regenerative braking equipment;	-	N.A.	O1
2.17.2.	"Electric regenerative braking equipment of category A" means an electric regenerative braking equipment which is not part of the service braking system;	S5.1.3.	Regenerative braking system. (a)For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral.	O1
2.17.3.	"Electric regenerative braking equipment of category B" means an electric regenerative braking equipment which is part of the service braking system;			O1

ECE R13-H		FMVSS135		Classification
Paragraph	Contents	Paragraph	Contents	
2.17.4.	"Electric State of Charge" means the instantaneous ratio of electric quantity of energy stored in the traction battery relative to the maximum quantity of electric energy which could be stored in this battery;	S6.3.11.1	The state of charge of the propulsion batteries is determined in accordance with SAE Recommended Practice J227a, Electric Vehicle Test Pro-cedure, February 1976. The applicable sections of J227a are 3.2.1 through 3.2.4, 3.3.1 through 3.3.2.2, 3.4.1 and 3.4.2, 4.2.1, 5.2, 5.2.1 and 5.3.	O2 To need to revise a SAE standard of quotation from "J227a" to "J1666".
2.17.5.	"Traction battery" means an assembly of accumulators constituting the storage of energy used for powering the traction motor(s) of the vehicle;	-	N.A.	O1
2.18.	"Phased braking" is a means which may be used where two or more sources of braking are operated from a common control, whereby one source may be given priority by phasing back the other source(s) so as to make increased control movement necessary before they begin to be brought into operation.	-	N.A.	T
2.19.	"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.	-	N.A.	T
2.20.	2.20. "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 behaviour modification.	-	N.A.	T
2.21.	"Nominal value definitions " for braking reference performance are required to put a value on the transfer function of the braking system, relating output to input for vehicles individually;	-	N.A.	T
2.21.1.	"Nominal value" is defined as the characteristic which can be demonstrated at Type Approval and which relates the braking rate of the vehicle on its own to the level of the braking input variable.	-	N.A.	T
3.	APPLICATION FOR APPROVAL.	-	N.A.	C3
4.	APPROVAL.	-	N.A.	C3
5. 5.1. 5.1.1.	SPECIFICATIONS. General Braking equipment			
5.1.1.1.	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.	S5.6.	Brake system integrity. Each vehicle shall meet the complete performance requirements of this standard without: (a) Detachment or fracture of any component of the braking system, such as brake springs and brake shoes or disc pad facings other than minor cracks that do not impair attachment of the friction facings. All mechanical components of the braking system shall be intact and functional. Friction facing tearout (complete detachment of lining) shall not exceed 10 percent of the lining on any single frictional element. (b) Any visible brake fluid or lubricant on the friction surface of the brake, or leakage at the master cyl-inder or brake power unit reservoir cover, seal, and filler openings.	O1
5.1.1.2.	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.	-	N.A.	O1
5.1.1.3	Brake linings shall not contain asbestos.	-	N.A.	O2
5.1.1.4.	The effectiveness of the braking equipment shall not be adversely affected by magnetic or electrical fields. (This shall be demonstrated by compliance with Regulation No. 10, 02 series of amendments.)	-	N.A.	P
5.1.1.5.	It shall be possible to generate maximum braking forces under static conditions on a rolling road or roller brake tester.	-	N.A.	C3

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5.1.1.6.	A failure detection signal may interrupt momentarily (< 10 ms) the demand signal in the control transmission, provided that the braking performance is not thereby reduced.	–	N.A.	T
5.1.2. 5.1.2.1.	Functions of the braking equipment The braking equipment defined in paragraph 2.3. must fulfil the following functions: 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.	S6. S6.5. S6.5.1.	General Test conditions. Procedual conditions. Brake control All service brake system performance requirements, includeing the partial system requirements of S7.7, S7.10 and S7.11, must be met solely by use of the service brake control.	O2
		S5.3. S5.3.1.	Controls. The service brakes shall be activated by means of a foot control.	
5.1.2.2.	Secondary braking system The secondary braking system must make it possible by application of the service brake control 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 without removing his hands from the steering control. For the purposes of these provisions it is assumed that not more than one failure of the service braking system can occur at one time.	S6. S6.5. S6.5.1.	General Test conditions. Procedual conditions. Brake control All service brake system performance requirements, includeing the partial system requirements of S7.7, S7.10 and S7.11, must be met solely by use of the service brake control.	O2
		S5.3. S5.3.1.	Controls. The service brakes shall be activated by means of a foot control.	
5.1.3.	The requirements of Annex 8 shall be applied to the safety aspects of all complex electronic vehicle control systems which provide or form part of the control transmission of the braking function included those which utilize the braking system(s) for automatically commanded braking or selective braking. However, systems or functions, which use the braking system as the means of achieving a higher level objective, are subject to Annex 8 only insofar as they have a direct effect on the braking system. If such systems are provided, they must not be deactivated during type Approval Testing of the braking system.	–	N.A.	T, C2
5.2	Characteristics of braking systems			
5.2.2.1	there must be at least two controls, independent of each other and readily accessible to the driver from his normal driving position.	S5.3.1	The service brakes shall be activated by means of a foot control. The control of the parking brake shall be independent of the service brake control, and may be either a hand or foot control.	O2
		S6.5.1	All service brake system performance requirements, including the partial system requirements of S7.7, S7.10 and S7.11, must be met solely by use of the service brake control.	
	Every brake control shall be designed such that it returns to the fully off position when released. This requirement shall not apply to a parking brake control when it is mechanically locked in an applied position;		N. A.	
5.2.2.3	the effectiveness of the linkage between the control of the service braking system and the different components of the transmission systems must not be liable to diminish after a certain period of use;		N. A.	O1
5.2.2.4	the parking braking system must be so designed that it can be actuated when the vehicle is in motion; This requirement may be met by the actuation of the vehicle's service braking system, even partially, by means of an auxiliary control.		N. A.	P Dynamic PKB

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Paragraph	Contents	Paragraph	Contents	
5.2.2.5	Without prejudice to the requirements of paragraph 5.1.2.3. of this Regulation, 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.		N. A.	T ・ P service brake and PKB may use common transmission
5.2.2.6	in the event of breakage of any component other than the brakes (as defined in paragraph 2.6. above) and the components referred to in paragraph 5.2.2.10. below, or of any other failure of the service braking system (malfunction, partial or total exhaustion of an energy reserve), that part of the service braking system which is not affected by the failure, must be able to bring the vehicle to a halt in the conditions prescribed for secondary braking;	S7.8, S7.9, S7.10, S7.11	Antilock functional failure. Variable brake proportioning system functional failure. Hydraulic circuit failure. Brake power unit or brake power assist unit inoperative (System depleted).	O2
5.2.2.7	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;	S7.11.3	(g)Disconnect the primary source of power for one brake power assist unit or brake power unit, or one of the brake power unit or brake power assist unit subsystems if two or more subsystems are provided. (h)If the brake power unit or power assist unit operates in conjunction with a backup system and the backup system is automatically activated in the event of a primary power service failure, the backup system is operative during this test.	O2
5.2.2.8	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, 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;	S7.11.3	(g)Disconnect the primary source of power for one brake power assist unit or brake power unit, or one of the brake power unit or brake power assist unit subsystems if two or more subsystems are provided. (h)If the brake power unit or power assist unit operates in conjunction with a backup system and the backup system is automatically activated in the event of a primary power service failure, the backup system is operative during this test.	C1
		S7.11.4	Performance requirements. The service brakes on a vehicle equipped with one or more brake power assist units or brake power units, with one such unit inoperative and depleted of all reserve capability, shall stop the vehicle as specified in S7.11.4(a) or	
	in addition, each of the aforesaid energy reserves must be equipped with a warning device as defined in paragraph 5.2.14. below;	S5.5	Brake system warning indicator. Each vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured with	
5.2.2.9	If the service braking force and transmission depend exclusively on the use of an energy reserve, one energy reserve for the transmission is deemed to be sufficient, provided that the prescribed secondary braking is ensured by the action of the driver's muscular energy acting on the service braking control and the requirements of paragraph 5.2.5. are met.	S7.11	Performance requirements. The service brakes on a vehicle equipped with one or more brake power assist units or brake power units, with one such unit inoperative and depleted of all reserve capability, shall stop the vehicle as specified in S7.11.4(a) or S7.11.4(b). (a)Stopping distance from 100 km/h test speed: 168 m (551 ft). (b)Stopping distance for reduced test speed: S 0.10V + 0.0158V 2 .	C1

ECE R13-H		FMVSS135		Classification
Paragraph	Contents	Paragraph	Contents	
5.2.2.10	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, the brake cylinders and their pistons, 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 features at least equal to those prescribed for other essential components (such as the steering linkage) of the vehicle.	S5.6	Brake system integrity. Each vehicle shall meet the complete performance requirements of this standard without: (a) Detachment or fracture of any component of the braking system, such as brake springs and brake shoes or disc pad facings other than minor cracks that do not impair attachment of the friction facings. All mechanical components of the braking system shall be intact and functional. Friction facing tearout (complete detachment of lining) shall not exceed 10 percent of the lining on any single frictional element. (b) Any visible brake fluid or lubricant on the friction surface of the brake, or leakage at the master cylinder or brake power unit reservoir cover, seal, and filler openings.	02
	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.	S7.17.(a)	The service brake system for detachment or fracture of any components, such as brake springs and brake shoes or disc pad facings.	
5.2.3	The 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 before or upon application of a differential pressure of not more than 15.5 bar between the active and failed brake equipment, measured at the master cylinder outlet and remaining lit as long as the failure persists and the ignition (start) switch is in the "on" (run) position.		Activation. An indicator shall be activated when the ignition (start) switch is in the ''on'' (''run'') position and whenever any of conditions (a) through (g) occur: (a)A gross loss of fluid or fluid pressure (such as caused by rupture of a brake line but not by a structural failure of a housing that is common to two or more subsystems) as indicated by one of the following conditions (chosen at the option of the manufacturer): (2)For vehicles equipped with a split service brake system, a differential pressure of 1.5 MPa (218 psi) between the intact and failed brake subsystems measured at a master cylinder outlet or a slave cylinder outlet.	02・P・03 FMVSS permits flashing warning light.
		S5.5.3 S5.5.4 S5.5.5	Duration. Each indicator activated due to a condition specified in S5.5.1 shall remain activated as long as the condition exists, whenever the ignition (''start'') switch is in the ''on'' (''run'') position, whether or not the engine is running. Function. When a visual warning indicator is activated, it may be continuous or flashing, except that the visual warning indicator on a vehicle not equipped with a split service brake system shall be flashing. The audible warning required for a vehicle manufactured without a split service brake system may be continuous or intermittent. Labeling. (a)Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the driver under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1 8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No. 101 and	

ECE R13-H		FMVSS135		Classification
Paragraph	Contents	Paragraph	Contents	
	However, a device comprising a red tell-tale signal lighting up when the fluid in the reservoir is below a certain level specified by the manufacturer is permitted.	S5.5.1	(a) A gross loss of fluid or fluid pressure (such as caused by rupture of a brake line but not by a structural failure of a housing that is common to two or more subsystems) as indicated by one of the following conditions (chosen at the option of the manufacturer): (1) A drop in the level of the brake fluid in any master cylinder reservoir compartment to less than the recommended safe level specified by the manufacturer or to one-fourth of the fluid capacity of that reservoir compartment, whichever is greater.	
	The tell-tale signal must be visible even by daylight; the satisfactory condition of the signal must be easily verifiable by the driver from the driver's seat.	S5.5	Each vehicle shall have one or more visual brake system warning indicators, mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a).	
	The failure of a component of the device must not entail total loss of the braking equipment's effectiveness.		N. A.	
	Application of the parking brake must also be indicated to the driver. The same tell-tale signal may be used.	S5.5.1(c)	(c) Application of the parking brake.	
5.2.4	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.		N. A.	**P ・ C2**
5.2.4.1	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. This condition must be met by means of devices which can easily be actuated when the vehicle is stationary, or by automatic means.	S7.11.3	(g)Disconnect the primary source of power for one brake power assist unit or brake power unit, or one of the brake power unit or brake power assist unit subsystems if two or more subsystems are provided. (h)If the brake power unit or power assist unit operates in conjunction with a backup system and the backup system is automatically activated in the event of a primary power service failure, the backup system is operative during this test.	**O2**
		S7.11.4	Performance requirements. The service brakes on a vehicle equipped with one or more brake power assist units or brake power units, with one such unit inoperative and depleted of all reserve capability, shall stop the vehicle as specified in S7.11.4(a) or	
5.2.4.2	Furthermore, storage devices located down-circuit of this device must be such that in the case of a failure in the energy supply after 4 full-stroke actuations of the service brake control, under the conditions prescribed in paragraph 1.2. of Annex 4 to this Regulation, it is still possible to halt the vehicle at the 5 th application, with the degree of effectiveness prescribed for secondary braking.	S7.11.3(i)	Exhaust any residual brake power reserve capability of the disconnected system.	**P ・ C2**
5.2.4.3	However, for hydraulic braking systems with stored energy, these provisions can be considered to be met provided that the requirements of paragraph 1.3. of Annex 4 to this Regulation, are satisfied.	S7.11.3(i)	Exhaust any residual brake power reserve capability of the disconnected system.	**P ・ C2**
5.2.5	The requirements of paragraphs 5.2.2. , 5.2.3. and 5.2.4. above must be met without the use of any automatic device of a kind such that its ineffectiveness might pass unnoticed through the fact that parts normally in a position of rest come into action only in the event of failure in the braking system.		N. A.	**C2・P・TE** To prohibit automatic device narmally in a position of rest in ECE.

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Paragraph	Contents	Paragraph	Contents	
5.2.6	The service braking system shall act on all the wheels of the vehicle and shall distribute its action appropriately among the axles.	S5.1 S7.2 S7.4	Service brake system. Each vehicle shall be equipped with a service brake system acting on all wheels. Wheel lockup sequence. Adhesion utilization (Torque Wheel Method).	O2
5.2.7	In the case of vehicles equipped with electric regenerative braking systems of category B, the braking input from other sources of braking, may be suitably phased to allow the electric regenerative braking system alone to be applied, provided that both the following conditions are met:		N,A.	T・P (RBS)
5.2.7.1	Intrinsic variations in the torque output of the electrical regenerative braking system (e.g. as a result of changes in the electric state of charge in the traction batteries) are automatically compensated by appropriate variation in the phasing relationship as long as the requirements 3/ of one of the following Annexes to this Regulation are satisfied: Annex 3 paragraph 1.3.2., or Annex 6 section 5.3. (including the case with the electric motor engaged), and		N,A.	T・P (RBS)
	3/ The Authority, which is to grant approval, shall have the right to check the service braking system by additional vehicle test procedures.			
5.2.7.2	Wherever necessary, to ensure that braking rate 3/ remains related to the driver 's braking demand, having regard to the available tyre/road adhesion, braking shall automatically be caused to act on all wheels of the vehicle.		N,A.	T
	3/ The Authority, which is to grant approval, shall have the right to check the service braking system by additional vehicle test procedures.			
5.2.8	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.		N,A.	C2
	Compensation and functions, such as anti-lock, which may cause deviations from this symmetrical distribution shall be declared .		N,A.	
5.2.8.1	Compensation by the electric control transmission for deterioration or defect within the braking system shall be indicated to the driver by means of the yellow warning signal specified in paragraph 5.2.21.1.2. below.		N,A.	T
	This requirement shall apply for all conditions of loading when compensation exceeds the following limits;		N,A.	
5.2.8.1.1	a difference in transverse braking pressures on any axle: (a) of 25% of the higher value for vehicle decelerations ≧ 2m/sec ^{2} , (b) a value corresponding to 25% at 2m/sec ^{2} for decelerations below this rate.		N,A.	T
5.2.8.1.2	an individual compensating value on any axle: (a) > 50% of the nominal value for vehicle decelerations ≧ 2m/sec ^{2} , (b) a value corresponding to 50% of the nominal value at 2m/sec 2 for decelerations below this rate.		N,A.	T
5.2.8.2	Compensation as defined above, is permitted only when the initial brake application is made at vehicle speeds >10 km/h.		N,A.	T
5.2.9	Malfunctions of the electric control transmission shall not apply the brakes contrary to the driver's intentions.		N,A.	T ・ C2

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5.2.10	The service, secondary and parking braking systems must act on braking surfaces connected to the wheels through components of adequate strength.		N,A.	T ・ TE
	Where braking torque for a particular axle or axles is provided by both a friction braking system and an electrical regenerative braking system of category B, disconnection of the latter source is permitted, providing that the friction braking source remains permanently connected and able to provide the compensation referred to in paragraph 5.2.7.1.		N,A.	
	However, in the case of short disconnection transients, incomplete compensation is accepted, but within 1 s, this compensation shall have attained at least 75% of its final value.		N,A.	
	Nevertheless, in all cases, the permanently connected friction braking source shall ensure that both the service and secondary braking systems continue to operate with the prescribed degree of effectiveness.		N,A.	
	Disconnection of the braking surfaces of the parking braking system shall be permitted only on condition that the disconnection is controlled exclusively by the driver from his driving seat, by a system incapable of being brought into action by a leak.		N,A.	(TE)
5.2.11.2	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.	S5.1.2.(b)	A means of visually checking the degree of brake lining wear, from the outside or underside of the vehicle, utilizing only the tools or equipment normally supplied with the vehicle. The removal of wheels is permitted for this purpose.	O2
	Alternatively, acoustic or optical devices warning the driver at his driving position when lining replacement is necessary are acceptable. The removal of front and / or rear wheels is permitted for this purpose.	S5.1.2(a) S5.5.1(d)	Acoustic or optical devices warning the driver at his or her driving position when lining replacement is necessary, Brake lining wear-out, if the manufacturer has elected to use an electrical device to provide an optical warning to meet the requirements of S5.1.2.(a).	O2
	The yellow warning signal specified in paragraph 5.2.21.1.2. below, may be used as the optical warning signal.	S5.5.5(a)	Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the driver under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1/8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No. 101 and this section may be provided for purposes of clarity.	P
		S5.5.5(6)	If a separate indicator is provided to indicate brake lining wear-out as specified in S5.5.1.(d), the words "Brake Wear" shall be used.	
5.2.12	In hydraulic-transmission braking systems, the filling ports of the fluid reservoirs must be readily accessible;	S5.4.3	Each vehicle equipped with hydraulic brakes shall have a brake fluid warning statement that reads as follows, in letters at least 3.2 mm (1/8 inch) high:"WARNING: Clean filler cap before removing. Use only ____ fluid from a sealed container." (Inserting the recommended type of brake fluid as specified in 49 CFR 571.116, e.g., "DOT 3.") The lettering shall be: (a) Permanently affixed, engraved or embossed; (b) Located so as to be visible by direct view, either on or within 100 mm (3.94inches) of the brake fluid reservoir filler plug or cap; and (c) Of a color that contrasts with its background, if it is not engraved or embossed.	O2
	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,	S5.4.4	Brake fluid reservoirs shall be so constructed that the level of fluid can be checked without need for the reservoir to be opened. This requirement is deemed to have been met if the vehicle is equipped with a transparent brake fluid reservoir or a brake fluid level indicator meeting the requirements of S5.5.1.(a)(1).	O2

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	and the minimum total reservoir capacity is equivalent to the fluid displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoirs move from a new lining, fully retracted position to a fully worn, fully applied position.	S5.4.2	Reservoirs, whether for master cylinders or other type systems, shall have a total minimum capacity equivalent to the fluid displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoirs move from a new lining, fully retracted position (as adjusted initially to the manufacturer' s recommended setting) to a fully worn, fully applied position, as determined in accordance with S7.17.(c) of this standard.	O2
	If these latter conditions are not fulfilled, the red warning signal specified in paragraph 5.2.21.1.1. below, shall draw the driver's attention to any fall in the level of reserve fluid liable to cause a failure of the braking system.	S5.5.1(a)(1)	A drop in the level of the brake fluid in any master cylinder reservoir compartment to less than the recommended safe level specified by the manufacturer or to one-fourth of the fluid capacity of that reservoir compartment, whichever is greater.	P FMVSS specifies Brake fluid warning lamp activate condition in detai.
5.2.13	The type of fluid to be used in hydraulic transmission braking systems shall be identified by the symbol in accordance with Figure 1 or 2 of ISO Standard 9128 - 1987 and the appropriate DOT marking (eg. DOT3). The symbol and the marking must be affixed in a visible position in indelible form within 100 mm of the filling ports of the fluid reservoirs; additional information may be provided by the manufacturer.	S5.4.3	Each vehicle equipped with hydraulic brakes shall have a brake fluid warning statement that reads as follows, in letters at least 3.2 mm (1/8 inch) high:"WARNING: Clean filler cap before removing. Use only ____ fluid from a sealed container." (Inserting the recommended type of brake fluid as specified in 49 CFR 571.116, e.g., "DOT 3.") The lettering shall be: (a) Permanently affixed, engraved or embossed; (b) Located so as to be visible by direct view, either on or within 100 mm (3.94inches) of the brake fluid reservoir filler plug or cap; and (c) Of a color that contrasts with its background, if it is not engraved or embossed.	P
5.2.14.1	Any vehicle fitted with a service brake actuated from an energy reservoir, where the prescribed secondary braking performance cannot be obtained by means of this brake without the use of the stored energy, must 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 5th time after 4 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. The red warning signal specified in paragraph 5.2.21.1.1. below, shall be used as the optical warning signal.	S5.5.1 S5.5.1(a)(3)	An indicator shall be activated when the ignition (start) switch is in the "on"("run") position and whenever any of conditions (a) through (g) occur: A drop in the supply pressure in a brake power unit to one-half of the normal system pressure.	O2
		S7.11	Brake power unit or brake power assist unit inoperative (System depleted).	FMVSS specifies in Test condition.
5.2.14.2	However, in the case of vehicles which are only considered to comply with the requirements of paragraph 5.2.4.1. of this Regulation by virtue of meeting the requirements of paragraph 1.3. of Annex 4 to this Regulation,	S.5.5	Each vehicle shall have one or more visual brake system warning indicators,mounted in front of and in clear view of the driver, which meet the requirements of S5.5.1. through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1.(a).	O2

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	【reference】Annex 4,1.3 1.3. Vehicles equipped with a hydraulic braking system with stored energy which cannot meet the requirements of paragraph 5.2.4.1. of this Regulation shall be deemed to satisfy that paragraph if the following requirements are met: 1.3.1. After any single transmission failure it shall still be possible after 8 full-stroke actuations of the service brake control, to achieve, at the 9th application, at least the performance prescribed for the secondary braking system. 1.3.2. Testing shall be performed in conformity with the following equirements: 1.3.2.1. With the energy source stationary or operating at a speed corresponding to the engine idling speed, any transmission failure may be induced. Before inducing such a failure, the energy storage device(s) shall be at a pressure that may be specified by the manufacturer but not exceeding the cut-in pressure. 1.3.2.2. The auxiliary equipment and its energy storage devices, if any, shall be isolated.			ECE R13H Annex4 1.3 Hydraulic braking systems with stored energy FMVSS Without a split service brake
5.2.14.3	This acoustic device may be rendered inoperative while the parking brake is applied and / or, at the choice of the manufacturer, in the case of automatic transmission the selector is in the "Park" position.	S5.5.3	Each indicator activated due to a condition specified in S5.5.1. shall remain activated as long as the condition exists, whenever the ignition ("start") switch is in the "on" ("run") position, whether or not the engine is running.	O2
5.2.15	Without prejudice to the requirements of paragraph 5.1.2.3. above, where an auxiliary source of energy is essential to the functioning of a braking system, the reserve of energy must be such as to ensure that, if the engine stops or in the event of a failure of the means by which the energy source is driven, the braking performance remains adequate to bring the vehicle to a halt in the prescribed conditions.	S7.7	Stops with Engine Off.	O2
	In addition, if the muscular effort applied by the driver to the parking braking system is reinforced by a servo device, the actuation of parking braking must be ensured in the event of a failure of the servo device, if necessary by using a reserve of energy independent of that normally supplying the servo device. This reserve of energy may be that intended for the service braking system.		N. A.	TE
5.2.16	The pneumatic/hydraulic auxiliary equipment must be supplied with energy in such a way that during its operation, the prescribed deceleration values can be reached and that even in the event of damage to the source of energy, the operation of the auxiliary equipment cannot cause the reserves of energy feeding the braking systems to fall below the level indicated in paragraph 5.2.14. above.		N. A.	TE
5.2.17	In the case of a motor vehicle equipped to tow a trailer with electric service brakes, the following requirements shall be met:		N. A.	T TE
5.2.17.1	the power supply (generator and battery) of the motor vehicle shall have a sufficient capacity to provide the current for an electric braking system. With the engine running at the idling speed recommended by the manufacturer and all electrical devices supplied by the manufacturer as standard equipment of the vehicle switched on, the voltage in the electrical lines shall at maximum current consumption of the electrical braking system (15 A) not fall below the value of 9.6V measured at the connection. The electrical lines shall not be capable of short circuiting even when overloaded;		N,A.	T TE
5.2.17.2	in the event of a failure in the motor vehicle's service braking system, where that system consists of at least two independent units, the unit or units not affected by the failure shall be capable of partially or fully actuating the brakes of the trailer;		N,A.	T TE

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5.2.17.3	the use of the stop-lamp switch and circuit for actuating the electrical braking system is permissible only if the actuating line is connected in parallel with the stop-lamp and the existing stop-lamp switch and circuit are capable of taking the extra load.		N,A.	T TE
5.2.18	Additional requirements for vehicles equipped with electric regenerative braking systems			
5.2.18.1	Vehicles fitted with an electric regenerative braking system of category A;		N,A.	P
5.2.18.1.1	the electric regenerative braking shall only be activated by the accelerator control and/or the gear neutral position.			
5.2.18.2	Vehicles fitted with an electric regenerative braking system of category B;	S5.1.3(a)	Regenerative braking system. For an EV equipped with RBS, the RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means provided for the driver to disconnect or otherwise deactivate it, and if it is activated in all transmission positions, including neutral.	P、TE
5.2.18.2.1	it must not be possible to disconnect partially or totally one part of the service braking system other than by an automatic means. This should not be braking system other than by an automatic means. This should not be construed as a departure from the requirements of paragraph 5.2.10.			
5.2.18.2.2	the service braking system must have only one control device;			P、TE
5.2.18.2.3	the service braking system must not be adversely affected by the disengagement of the motor(s) or by the gear ratio used;		N,A.	P、TE、C2
5.2.18.2.4	if the operation of the electric component of braking is ensured by a relationship established between information coming from the service brake control and the resulting braking force to the wheels, a failure of this relationship leading to the non respect of the prescriptions of distribution of braking among the axles (Annex 5 or 6, whichever is applicable) must be warned to the driver by an optical warning signal at the latest when the control is actuated and having to remain lit as long as this defect exists and the switch "contact" is in the "go" position		N,A.	P、T
5.2.18.3	For vehicles fitted with an electric regenerative braking system of both categories, all the relevant prescriptions shall apply except paragraph 5.2.18.1.1. above. In this case,the electric regenerative braking may be activated by the accelerator control and/or the gear neutral position. Additionally, the action on the service braking control must not reduce the above braking effect generated by the release of the accelerator control;		N,A.	P、TE
5.2.18.4	The operation of the electric braking must not be adversely affected by magnetic or electric fields;		N,A.	P
5.2.18.5	For vehicles equipped with an anti-lock device, the anti-lock device must control the electric braking system.	S5.1.3(b)	For an EV that is equipped with both ABS and RBS that is part of the service brake system, the ABS must control the RBS.	TE、P
5.2.19	Special additional requirements for the Electric transmission of the Parking Braking system:		N,A.	T
5.2.19.1	In the case of a failure within the electric transmission, any unintended actuation of the parking braking system shall be prevented;		N. A.	T

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5.2.19.2	In the case of a break in the wiring within the electric control transmission external to the electronic control unit(s) and excluding the energy supply, or a failure in the control, it shall remain possible to apply the parking braking system from the driver's seat and thereby be capable of holding the laden vehicle stationary on an 8% up or down gradient.Alternatively, in this case, an automatic actuation of the parking brake is allowed when the vehicle is stationary, provided that the above performance is achieved and, once applied, the parking brake remains engaged independently of the status of the ignition(start) switch. In this alternative, the parking brake shall be automatically released as soon as the driver starts to set the vehicle in motion again.The engine/manual transmission or the automatic transmission (park position) may be used to achieve the above performance;It shall also be possible to release the parking braking system, if necessary by the use of an auxiliary release device carried/fitted on the vehicle		N,A.	T
5.2.19.2.1	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 by the yellow warning signal specified in paragraph 5.2.21.1.2. When caused by a break in the wiring within the electric control transmission of the parking braking system, this yellow warning signal shall be signalled as soon as the break occurs.		N,A.	T
	In addition, such a failure in the control or break in the wiring external to the electronic control unit(s) and excluding the energy supply, shall be signalled to the driver by flashing the red warning signal specified in paragraph 5.2.1.21.1.1 . as long as the ignition (start) witch is in the "on" (run) position including a period of not less than 10 seconds hereafter and the control is in the "on" (activated) position.			T
	Where actuation of the parking brake is normally indicated by a separate red warning signal, satisfying all the requirements of paragraph 5.2.21.2, this signal shall be used to satisfy the above requirement for a red signal.			T
5.2.19.3	Auxiliary equipment may be supplied with energy from the electric transmission of the parking braking system, provided that the supply of energy is sufficient to allow the actuation of the parking braking system in addition to the vehicle electrical load under non-fault conditions. In addition, where the energy reserve is also used by the service braking system, the requirements of paragraph 5.2.20.6. below, shall apply;		N,A.	T
5.2.19.4	After the ignition/start switch, which controls the electrical energy for the braking equipment, has been switched off and/or the key removed, it shall remain possible to apply the parking braking system, whereas releasing shall be prevented.		N,A.	T
5.2.20.	Special additional requirements for service braking systems with electric control transmission:		N.A.	T
5.2.20.1	With the parking brake released, the service braking system shall be able to generate a static total braking force at least equivalent to that required by the prescribed Type-0 test, even when the ignition/start switch has been switched off and/or the key has been removed. It should be understood that sufficient energy is available in the energy transmission of the service braking system;		N.A.	T

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5.2.20.2.	In the case of a single temporary failure (< 40 ms) within the electric control transmission, excluding its energy supply, (e.g. non transmitted signal or data error) there shall be no distinguishable effect on the service braking performance;		N.A.	T
5.2.20.3.	A failure within the electric control transmission 6/ , not including its energy reserve, that affects the function and performance of the systems addressed in this Regulation, shall be indicated to the driver by the red or yellow warning signal specified in paragraphs 5.2.21.1.1. and 5.2.21.1.2. below, respectively,as appropriate. When the prescribed service braking performance can no longer be achieved(red warning signal), failures resulting from a loss of electrical continuity (eg. breakage, disconnection) shall be signalled to the driver as soon as they occur, and the prescribed secondary braking performance shall be fulfilled by operating the service braking control in accordance with paragraph 2.2. of Annex 3 to this Regulation. These requirements shall not be construed as a departure from the requirements concerning secondary braking. 6/ Until uniform test procedures have been agreed, the manufacturer shall provide the Technical Service with an analysis of potential failures within the control transmission and their effects. This information (as in Annex 8) shall be subject to discussion and agreement between the Technical Service and the vehicle manufacturer.		N.A.	T
5.2.20.4.	In the event of a failure of the energy source of the electric control transmission, starting from the nominal value of the energy level, the full control range of the service braking system shall be guaranteed after 20 consecutive full stroke actuations of the service braking control. During the test, the braking control shall be fully applied for 20 seconds and released for 5 seconds on each actuation. It should be understood that during the above test sufficient energy is available in the energy transmission to ensure full actuation of the service braking system. This requirement shall not be construed as a departure from the requirements of Annex 4.		N.A.	T
5.2.20.5.	When the battery voltage falls below a value nominated by the manufacturer at which the prescribed service braking performance can no longer be guaranteed and/or which precludes at least two independent service braking circuits from each achieving the prescribed secondary braking performance, the red warning signal specified in paragraph 5.2.21.1.1. below, shall be activated. After the warning signal has been activated, it shall be possible to apply the service braking control and obtain at least the secondary performance prescribed in paragraph 2.2. of Annex 3 to this Regulation. It should be understood that sufficient energy is available in the energy transmission of the service braking system.		N.A.	T

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5.2.20.6.	If the auxiliary equipment is supplied with energy from the same reserve as the electric control transmission, it shall be ensured that, with the engine running at a speed not greater than 80% of the maximum power speed, the supply of the energy is sufficient to fulfil the prescribed deceleration values by either: Provision of an energy supply which is able to prevent discharge of this reserve when all the auxiliary equipment is functioning or: Switching off pre-selected parts of the auxiliary equipment at a voltage above the critical level referred to in paragraph 5.2.20.5. of this Regulation such that further discharge is prevented. Compliance with this requirement may be demonstrated by calculation or by a practical test. This paragraph does not apply to vehicles where the prescribed deceleration values can be reached without the use of electrical energy.		N.A.	T
5.2.20.7.	If the auxiliary equipment is supplied with energy from the electric control transmission, the following requirements shall be fulfilled:		N.A.	T
5.2.20.7.1.	In the event of a failure in the energy source, whilst the vehicle is in motion, the energy in the reservoir shall be sufficient to actuate the brakes when the control is applied;		N.A.	T
5.2.20.7.2.	In the event of a failure in the energy source, whilst the vehicle is stationary and the parking braking system applied, the energy in the reservoir shall be sufficient to actuate the lights even when the brakes are applied.		N.A.	T
5.2.21.	Brake failure and defect warning signals. The general requirements for optical warning signals, whose function is to indicate to the driver certain specified failures (or defects) within the braking equipment of the motor vehicle, are set out in the following sub-paragraphs. Other than as described in paragraph 5.2.21.5. below, these signals shall be used exclusively for the purposes prescribed by this Regulation.	S5.5.	Brake system warning indicator. Each vehicle shall have one or more visual brake system warning indica-tors, mounted in front of and in clear view of the driver, which meet the re-quirements of S5.5.1 through S5.5.5. In addition, a vehicle manufactured without a split service brake system shall be equipped with an audible warning signal that activates under the conditions specified in S5.5.1(a).	P, T, O3 ・FMVSS: letter ＋collor ECE: symbol + collor ←P audible warning signal for without a split service brake
5.2.21.1.	Motor vehicles shall be capable of providing optical brake failure and defect warning signals, as follows;	S5.5.1.	Activation. An indicator shall be activated when the ignition (start) switch is in the ″on″ (″run″) position and whenever any of conditions (a) through (g) occur:	
5.2.21.1.1.	A red warning signal, indicating failures, defined elsewhere in this Regulation, within the vehicle braking equipment which precludes achievement of the prescribed service braking performance and/or which precludes the functioning of at least one of two independent service braking circuits;		(a) A gross loss of fluid or fluid pressure (such as caused by rupture of a brake line but not by a structural failure of a housing that is common to two or more subsystems) as indicated by one of the following conditions (chosen at the option of the manufacturer):	
5.2.21.1.2.	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 described in paragraph 5.2.21.1.1. above.		(1) A drop in the level of the brake fluid in any master cylinder reservoir compartment to less than the recommended safe level specified by the manufacturer or to one-fourth of the fluid capacity of that reservoir compartment, whichever is greater.	←P 1/4 fluid capacity
5.2.21.2.	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.		(2) For vehicles equipped with a split service brake system, a differential pressure of 1.5 MPa (218 psi) between the intact and failed brake subsystems measured at a master cylinder outlet or a slave cylinder outlet.	
			(3) A drop in the supply pressure in a brake power unit to one-half of the normal system pressure.	←P

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5.2.3.	The failure of a part of a hydraulic transmission system shall besignalled to the driver by a device comprising a red tell-tale signal lighting up before or upon application of a differential pressure of not more than 15.5 bar between the active and failed brake equipment, measured at the master cylinder outlet and remaining lit as long as the failure persists and the ignition (start) switch is in the "on" (run) position. However, a device comprising a red tell-tale signal lighting up when the fluid in the reservoir is below a certain level specified by the manufacturer is permitted. The tell-tale signal must be visible even by daylight; the satisfactory condition of the signal must be easily verifiable by the driver from the driver's seat. The failure of a component of the device must not entail total loss of the braking equipment's effectiveness.		(b) Any electrical functional failure in an antilock or variable brake proportioning system. (c) Application of the parking brake. (d) Brake lining wear-out, if the manufacturer has elected to use an electrical device to provide an optical warning to meet the requirements of S5.1.2(a).(e) For a vehicle with electrically-actuated service brakes, failure of the source of electric power to those brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a driver of degraded brake performance. (f) For a vehicle with electric transmission of the service brake control signal, failure of a brake control circuit. (g) For an EV with a regenerative braking system that is part of the service brake system, failure of the RBS.	←T ・EBS ←O3 (EV)
	Application of the parking brake must also be indicated to the driver. The same tell-tale signal may be used.	S5.5.5.	Labeling. (a) Each visual indicator shall display a word or words in accordance with the requirements of Standard No. 101 (49 CFR 571.101) and this section, which shall be legible to the driver under all daytime and nighttime conditions when activated. Unless otherwise specified, the words shall have letters not less than 3.2 mm (1/8 inch) high and the letters and background shall be of contrasting colors, one of which is red. Words or symbols in addition to those required by Standard No. 101 and this section may be provided for purposes of clarity.	←O3
5.2.8.1.	Compensation by the electric control transmission for deterioration or defect within the braking system shall be indicated to the driver by means of the yellow warning signal specified in paragraph 5.2.21.1.2. below. This requirement shall apply for all conditions of loading when compensation exceeds the following limits:		(b) Vehicles manufactured with a split service brake system may use a common brake warning indicator to indicate two or more of the functions described in S5.5.1(a) through S5.5.1(d). If a common indicator is used, it shall display the word "Brake." (c) A vehicle manufactured without a split service brake system shall use a separate indicator to indicate the failure condition in S5.5.1(a). This indicator shall display the words "STOP-BRAKE FAILURE" in block capital letters not less than 6.4 mm (1/ 4 inch) in height.	←O3 ←P, O3 ・FMVSS: permit without a split service brake
5.2.11.2.	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 and/or rear wheels is permitted for this purpose. The yellow warning signal specified in paragraph 5.2.21.1.2. below may be used as the optical warning signal.		(d) If separate indicators are used for one or more of the conditions described in S5.5.1(a) through S5.5.1(g), the indicators shall display the following wording: (1) If a separate indicator is provided for the low brake fluid condition in S5.5.1(a)(1), the words "Brake Fluid" shall be used except for vehicles using hydraulic system mineral oil. (2) If a separate indicator is provided for the gross loss of pressure condition in S5.5.1(a)(2), the words "Brake Pres-sure" shall be used.	←O3 ←O3
5.2.12.	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, and the minimum total reservoir capacity is equivalent to the fluid displacement resulting when all the wheel cylinders or calliper pistons serviced by the reservoirs move from a new lining, fully retracted position to a fully worn, fully applied position. If these latter conditions are not fulfilled, the red warning signal specified in paragraph 5.2.21.1.1. below shall draw the driver's attention to any fall in the level of reserve fluid liable to cause a failure of the braking system.		(3) If a separate indicator is provided for the condition specified in S5.5.1(b), the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled with the words "Antilock" or "Anti-lock"or "ABS"; or "Brake Proportioning," in accordance with Table 2 of Standard No. (4) If a separate indicator is provided for application of the parking brake as specified for S5.5.1(c), the single word "Park" or the words "Parking Brake" may be used. (5) If a separate indicator is provided to indicate brake lining wear-out as specified in S5.5.1(d), the words "Brake Wear" shall be used.	←O3 ・ABS、Proportioning、RBS letter vs symbol ←T, O3 ・Brake Wear letter vs symbol ←O3 ・letter + Red color vs symbol + yellow

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5.2.14.1.	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,		(6) If a separate indicator is provided for the condition specified in S5.5.1(g), the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled with the symbol "RBS." RBS failure in a system that is part of the service brake system may also be indicated by a yellow lamp that also indicates "ABS" failure and displays the symbol "ABS/RBS."	←O3
	it is possible to apply the service brake control a fifth time after four 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. The red warning signal specified in paragraph 5.2.21.1.1. below shall		(7) If a separate indicator is provided for any other function, the display shall include the word "Brake" and the appropriate additional labeling.	←O3
5.2.14.2.	However, in the case of vehicles which are only considered to comply with the requirements of paragraph 5.2.4.1. of this Regulation by virtue of meeting the requirements of paragraph 1.3. of annex 4 to this Regulation, the warning device shall consist an acoustic signal in addition to an optical signal. These devices need not operate simultaneously, provided that each of them meets the above requirements and the acoustic signal is not actuated before the optical signal. The red warning signal specified in paragraph 5.2.21.1.1. below shall be used as the optical warning signal.			
5.2.18.2.4.	if the operation of the electric component of braking is ensured by a relation established between information coming from the control of the service brake and the braking force to the wheels which of it results, a failure of this relation leading to the non-respect of the prescriptions of distributor of braking among the axles (annex 5 or 6, which is applicable) must be warned to the driver by an optical warning signal at the latest when the control is actuated and having to remain lit as long as this defect exists and that the switch of "contact" is in the position "go".			
5.2.19.2.1.	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 by the yellow warning signal specified in paragraph 5.2.21.1.2. When caused by a break in the wiring within the electric control transmission of the parking braking system, this yellow warning signal shall be signalled as soon as the break occurs In addition, such a failure in the control or break in the wiring external to the electronic control unit(s) and excluding the energy supply shall be signalled to the driver by flashing the red warning signal specified in paragraph 5.2.21.1.1. as long as the ignition (start) switch is in the "on" (run) position including a period of not less than 10 seconds thereafter and the control is in the "on" (activated) position. Where actuation of the parking brake is normally indicated by a separate red warning signal, satisfying all the requirements of paragraph 5.2.21.2., this signal shall be used to satisfy the above requirement for a red signal.			

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5.2.20.3.	A failure within the electric control transmission 4/, not including its energy reserve, 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 specified in paragraphs 5.2.21.1.1. and 5.2.21.1.2., respectively, as appropriate. When the prescribed service braking performance can no longer be achieved (red warning signal), failures resulting from a loss of electrical continuity (e.g. breakage, disconnection) shall be signalled to the driver as soon as they occur, and the prescribed residual braking performance shall be fulfilled by operating the service braking control in accordance with paragraph 2.2. of annex 3 to this Regulation. These requirements shall not be construed as a departure from the requirements concerning secondary braking.			
5.2.20.5.	When the battery voltage falls below a value nominated by the manufacturer at which the prescribed service braking performance can no longer be guaranteed and/or which precludes at least two independent service braking circuits from each achieving the prescribed secondary or residual braking performance, the red warning signal specified in paragraph 5.2.21.1.1. below shall be activated. After the warning signal has been activated, it shall be possible to apply the service braking control and obtain at least the residual performance prescribed in paragraph 2.2. of annex 3 to this Regulation. It should be understood that sufficient energy is available in the energy transmission of the service braking system. This requirement shall not be construed as a departure from the requirement concerning secondary braking.			
Annex6 4.1.	Any electrical failure or sensor anomaly that affects the system with respect to the functional and performance requirements in this annex, including those in the supply of electricity, the external wiring to the controller(s), the controller(s) 2/and the modulator(s) shall be signaled to the diver by a specific optional warning signal. The yellow warning signal specified in paragraph 5.2.21.1.2. of this Regulation shall be used for this purpose.			
5.2.21.3.	Except where stated otherwise:			—
5.2.21.3.1.	a specified failure or defect shall be signalled to the driver by the above mentioned warning signal(s) not later than on actuation of the relevant braking control;	S5.5.1.	Activation. An indicator shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions (a) through (g) occur:	**O1, O2** ・Time to be activated
5.2.21.3.2.	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.	S5.5.3.	Duration. Each indicator activated due to a condition specified in S5.5.1 shall remain activated as long as the condition exists, whenever the ignition ("start") switch is in the "on" ("run") position, whether or not the engine is running.	**Eqv.**
5.2.21.3.3.	The warning signal shall be constant (not flashing).	S5.5.4.	Function. When a visual warning indicator is activated, it may be continuous or flashing, except that the visual warning indicator on a vehicle not equipped with a split service brake system shall be flashing. The audible warning required for a vehicle manufactured without a split service brake system may be continuous or intermittent.	**P** ・Requirement of flashing warining indicator for without a split service brake

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5.2.21.4.	The warning signal(s) mentioned above shall light up when the electrical equipment of the vehicle (and the braking system) is energised. With the vehicle stationary, the braking system shall verify that none of the specified failures or defects are present before extinguishing the signals. Specified failures or defects which should activate the warning signals mentioned above, but which are not detected under static conditions, shall be stored upon detection and be displayed at start-up and at all times when the ignition (start) switch is in the "on" (run) position, as long as the failure or defect persists.	S5.5.2.	Function check. (a) All indicators shall be activated as a check function by either: (1) Automatic activation when the ignition (start) switch is turned to the "on" ("run") position when the engine is not running, or when the ignition ("start") switch is in a position between "on" ("run") and "start" that is designated by the manufacturer as a check position, or (2) A single manual action by the driver, such as momentary activation of a test button or switch mounted on the instrument panel in front of and in clear view of the driver, or, in the case of an indicator for application of the parking brake, by applying the parking brake when the ignition is in the "on" ("run") position. (b) In the case of a vehicle that has an interlock device that prevents the engine from being started under one or more conditions, check functions meeting the requirements of S5.5.2(a) need not be operational under any condition in which the engine cannot be started. (c) The manufacturer shall explain the brake check function test procedure in the owner's manual.	**C1** ・Permit a test switch. Require explanation of function test procedure in owner's manual.
5.2.21.5.	Non-specified failures (or defects) or other information concerning the brakes and/or running gear of the motor vehicle, may be indicated by the yellow signal specified in paragraph 5.2.21.1.2. above, provided that all the following conditions are fulfilled:		N.A.	**T**
5.2.21.5.1.	the vehicle is stationary;		N.A.	**T**
5.2.21.5.2.	after the braking equipment is first energised and the signal has indicated that, following the procedures detailed in paragraph 5.2.21.4. above, no specified failures (or defects) have been identified;		N.A.	**T**
5.2.21.5.3.	non-specified faults or other information shall be indicated only by the flashing of the warning signal. However, the warning signal shall be extinguished by the time when the vehicle first exceeds 10 km/h.		N.A.	**T**
7.	**MODIFICATION OF VEHICLE TYPE OR BRAKING SYSTEM AND EXTENSION OF APPROVAL.**		N.A.	**C3**
7.1.	Every modification of the vehicle type or of its braking system shall be notified to the administrative department which approved the vehicle type. That department may then either:		N.A.	**C3**
7.1.1.	consider that the modifications made are unlikely to have an appreciable adve rse effect and that in any case the vehicle still meets the requirements; or		N.A.	**C3**
7.1.2.	require a further report from the Technical Service responsible for carrying out the tests.		N.A.	**C3**
7.2.	Notice of confirmation, extension, or refusal of approval shall be communicated by the procedure specified in paragraph 4.3. above, to the Parties to the Agreement which apply this Regulation.		N.A.	**C3**
7.3.	The competent authority issuing the extension of approval shall assign a series of numbers to each communication form drawn up for such an extension.		N.A.	**C3**
8.	**CONFORMITY OF PRODUCTION.** The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324 – E/ECE/TRANS/505/Rev.2) with the following requirements:		N.A.	**C3**
8.1.	A vehicle approved to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set forth in paragraph 5. above.		N.A.	**C3**

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8.2.	The authority which has granted type approval may at any time verify the conformity control methods applied in each production facility. The normal frequency of these verifications shall be once every two years.		N.A.	C3
9.	**PENALTIES FOR NON-CONFORMITY OF PRODUCTION.**		N.A.	C3
9.1.	The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 8.1. above are not complied with.		N.A.	C3
9.2.	If a Contracting Party to the Agreement which applies this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by means of a copy of the communication form conforming to the model in Annex 1 to this Regulation.		N.A.	C3
10.	**PRODUCTION DEFINITELY DISCONTINUED.** If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the Agreement applying this Regulation by means of copies of a communication form conforming to the model in Annex 1 to this Regulation.		N.A.	C3
11.	**NAMES AND ADDRESSES OF THE TECHNICAL SERVICES CONDUCTING APPROVAL TESTS AND OF ADMINISTRATIVE DEPARTMENTS.** The parties to the Agreement applying this Regulation sha ll communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, issued in other countries, are to be sent.		N.A.	C3
Annex1			N.A.	C3
Annex2	**ARRANGEMENTS OF APPROVAL MARKS.**		N.A.	C3
Annex3	**BRAKING TESTS AND PERFORMANCE OF BRAKING SYSTEMS.**			—
1.	**BRAKING TESTS.**			—
1.1.	General	S6.	General test conditions.	—
1.1.1.	The performance prescribed for braking systems is based on the stopping distance and the mean fully developed deceleration. 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	S6.5.3.1.	The braking performance of a vehicle is determined by measuring the stopping distance from a given initial speed.	P ・No MFDD is prescribed in MVSS.
1.1.2.	The stopping distance shall be the distance covered by the vehicle from the moment when the driver begins to activate the control of the braking system until the moment when the vehicle stops; the initial speed shall be the speed at the moment when the driver begins to activate the control of the braking system; the initial speed shall not be less than 98% of the prescribed speed for the test in question.	S6.5.3.3.	In the stopping distance formulas given for each applicable test (such as $S \leqq 0.10\ V+0.0060V^2$), S is the maximum stopping distance in meters, and V is the test speed in km/h.	

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	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: $MFDD\ dm = \frac{vb^2 - ve^2}{25.92(Se - Sb)}\ m/s^2$ where: vo = initial vehicle speed in km/h, vb = vehicle speed at 0.8 vo in km/h, ve = vehicle speed at 0.1 vo in km/h, Sb= distance travelled between vo and vb in metres, Se = distance travelled between vo and ve in metres. The speed and distance shall be determined using instrumentation having an accuracy of ± 1% at the prescribed speed for the test. The dm may be determined by other methods than the measurement of speed and distance; in this case, the accuracy of the dm shall be within ± 3%.			
1.2.2.	the test must be carried out at the speeds prescribed for each type of test; 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;	S6.5. S6.5.2.	Procedural conditions. Test speeds. If a vehicle is incapable of attaining the specified normal test speed, it is tested at a speed that is a multiple of 5 km/h (3.1 mph) that is 4 to 8 km/h (2.5 to 5.0 mph) less than its maximum speed and its performance must be within a stopping distance given by the formula provided for the specific requirement.	**C1**
1.2.4.	the road must have a surface affording good adhesion, unless specified otherwise in the relevant annexes;	S6.2. S6.2.1.	Road test surface. Pavement friction. Unless otherwise specified, the road test surface produces a peak friction coefficient (PFC) of 0.9 when measured using an American Society for Testing and Materials (ASTM) E1136 standard reference test tire, in accordance with ASTM Method E 1337–90, at a speed of 64.4 km/h (40 mph), without water delivery.	**C1** ・FMVSS：Prescrive mesuring procedure of the pavemem fliction and the fliction value.
1.2.5.	the tests must be performed when there is no wind liable to affect the results;	S6.1 S6.1.2.	Ambient conditions. Wind speed. The wind speed is not greater than 5 m/s (11.2 mph).	**C1** ・FMVSS：Prescrive wind speed
1.2.6.	at the start of the tests, the tyres must be cold and at the pressure prescribed for the load actually borne by the wheels when the vehicle is stationary;	S6.3. S6.3.8.	Vehicle conditions. Tire inflation pressure. Tires are inflated to the pressure recommended by the vehicle manufacturer for the GVWR of the vehicle.	**P** ・FMVSS：Priscrive tire air pressure for GVWR
1.2.7.	the prescribed performance must be obtained without locking of the wheels at speeds exceeding 15 km/h, without deviation of the vehicle, from a 3.5 m wide lane, without exceeding a yaw angle of 15° and without abnormal vibrations;	S6.2. S6.2.3. S6.5. S6.5.4. S6.5.4.1. S6.5.4.2.	Road test surface. Lane width. Road tests are conducted on a test lane 3.5 m (11.5 ft) wide. Procedural conditions. Vehicle position and attitude. The vehicle is aligned in the center of the lane at the start of each brake application. Steering corrections are permitted during each stop. Stops are made without any part of the vehicle leaving the lane and without rotation of the vehicle about its vertical axis of more than ±15° from the center line of the test lane at any time during any stop.	**C1** **←C1** ・FMVSS：To start braking in the center of the lane.
1.2.8.	For vehicles powered completely or partially by an electric motor (or motors), permanently connected to the wheels, all tests must be carried out with these motor(s) connected.		N.A.	**O1** **(EV)**

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1.2.9.	for vehicles as described in paragraph 1.2.8., fitted with an electric regenerative braking system of category A, behaviour tests defined in paragraph 1.4.3.1. of this Annex shall be carried out on a track with a low adhesion coefficient (as defined in paragraph 5.2.2. of Annex 6) ;		N.A.	**P** **(EV)**
1.2.9.1.	moreover, for vehicles fitted with an electric regenerative braking system of category A, transient conditions such as gear changes or accelerator control release, must not affect the behaviour of the vehicle in conditions described in paragraph 1.2.9. ;		N.A.	**P, C2** **(EV)**
1.2.10.	in the tests provided in paragraphs 1.2.9. and 1.2.9.1. wheel locking is not allowed. However steering correction is permitted if the angular rotation of the steering control is within120° during the initial 2 seconds and not more than 240° in all.		N.A.	**P, C2** **(EV)**
1.2.11.	For a vehicle with electrically actuated service brakes powered from traction batteries (or an auxiliary battery) which receive(s) energy only from an independent external charging system, these batteries shall, during braking performance testing, be at an average of not more than 5% above that (low) state of charge at which the brake failure warning prescribed in paragraph 5.2.20.5. is required to be given. If this warning is given, the batteries may receive some recharge during the tests, to keep them in the required state-of-charge range.	S6.3.12.	State of charge of batteries for electrically-actuated service brakes. (a) For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at not more than five percent above the EV actual automatic shut-down critical value. The critical value is determined by measuring the state-of-charge of each propulsion battery at the instant that automatic shut-down occurs. (b) For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with no automatic shut-down capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated. (c) For a vehicle which has one or more auxiliary batteries that provides electrical energy to operate the electrically-actuated service brakes, each auxiliary battery is at not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated.	**TE** **(EV)** ・FMVSS：To assume automatic shut-down of propulsion motor.
1.3.	Behaviour of the vehicle during braking			**—**
1.3.2.	Behaviour of the vehicle during braking on a road on which adhesion is reduced must meet the relevant requirements of Annex 5 and/or Annex 6 to this Regulation.			**P, C1, C2, C3, O2**
Annex5	DISTRIBUTION OF BRAKING AMONG THE AXLES OF VEHICLES 【see the validation of Annex5 for details】			**P, C2, C3, O2**
Annex6	TEST REQUIREMENTS FOR VEHICLES FITTED WITH ANTI-LOCK SYSTEMS 【see the validation of Annex6 for details】	S7.3. S7.8.	ABS performance. [Reserved] Antilock functional failure.	**P, C1** **←P** **←C1,**
1.3.2.1.	In the case of a braking system according to paragraph 5.2.7. Where the braking for a particular axle (or axles) is comprised of more than one source of braking torque, and any individual source can be varied with respect to the other(s), the vehicle shall satisfy the requirements of Annex 5, or alternatively, Annex 6 under all relationships permitted by its control strategy 1/. 1/ The manufacturer shall provide the Technical Service with the family ofbraking curves permitted by the automatic control strategy.These curves may be verified by the Technical Service.		N.A.	**P, T, C2** **(EV)**
1.4.	Type-0 test (ordinary performance test with cold brakes)			**—**
1.4.1.	General			**—**

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1.4.1.1.	The average temperature of the service brakes on the hottest axle of the vehicle, measured inside the brake linings or on the braking path of the disc or drum, is between 65 and 100° C prior to any brake application.	S4.	Definitions. Initial brake temperature or IBT means the average temperature of the service brakes on the hottest axle of the vehicle 0.32 km (0.2 miles) before any brake application.	C1
		S6.4.1.	Brake temperature measurement. The brake temperature is measured by plug-type thermocouples installed in the approximate center of the facing length and width of the most heavily loaded shoe or disc pad, one per brake, as shown in Figure 1. A second thermocouple may be installed at the beginning of the test sequence if the lining wear is expected to reach a point causing the first thermocouple to contact the metal rubbing surface of a drum or rotor. For center-grooved shoes or pads, thermocouples are installed within 3 mm (.12 in) to 6 mm (.24 in) of the groove and as close to the center as possible.	
		S7.5. S7.5.2.	Cold effectiveness. Test conditions and procedures. (a) IBT: ≧65 ° C (149 ° F), ≦100 ° C (212 ° F).	
		S7.6. S7.6.2.	High speed effectiveness. Test conditions and procedures. (a) IBT: ≧65 ° C (149 ° F), ≦100 ° C (212 ° F).	
1.4.1.2.	The test must be conducted in the following conditions:	S6.3.	Vehicle conditions.	—
1.4.1.2.1.	the vehicle must be laden, 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 mass on each axle is proportional to the maximum permissible mass for each axle;	S6.3.1. S6.3.1.1.	Vehicle weight. For the tests at GVWR, the vehicle is loaded to its GVWR such that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR, with the fuel tank filled to 100% of capacity. However, if the weight on any axle of a vehicle at LLVW exceeds the axle's proportional share of the GVWR, the load required to reach GVWR is placed so that the weight on that axle remains the same as at LLVW.	C1 ・FMVSS：Prescrive the procedure for adjusting axle weight.
1.4.1.2.2.	every test must be repeated on the unladen vehicle; there may be, in addition to the driver, a second person on the front seat who is responsible for noting the results of the test;			
1.4.1.2.4.	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, but it may not be necessary to actually measure both parameters;	S6.3.1.2.	For the test at LLVW, the vehicle is loaded to its LLVW such that the added weight is distributed in the front passenger seat area.	
		S7.5. S7.5.1.	Cold effectiveness. Vehicle conditions. (a) Vehicle load: GVWR and LLVW.	
		S7.6. S7.6.1	High speed effectiveness. Vehicle conditions. (a) Vehicle load: GVWR and LLVW.	
1.4.1.2.5.	the road must be level; unless otherwise specified each test may comprise up to 6 stops including any needed for familiarization.	S6.2. S6.2.2.	Road test surface. Gradient. Except for the parking brake gradient holding test, the test surface has no more than a 1% gradient in the direction of testing and no more than a 2% gradient perpendicular to the direction of testing.	C1 ・FMVSS：Prescrive the test surface gradient value for the direction and the perpendicular to the direction.
		S6.5.3.2.	Unless otherwise specified, the vehicle is stopped in the shortest distance achievable (best effort) on all stops. Where more than one stop is required for a given set of test conditions, a vehicle is deemed to comply with the corresponding stopping distance requirements if at least one of the stops is made within the prescribed distance.	

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		S7.5. S7.5.2. S7.6. S7.6.2.	Cold effectiveness. Test conditions and procedures. (e) Number of runs: 6 stops. High speed effectiveness. Test conditions and procedures. (e) Number of runs: 6 stops.	
1.4.2.	Type-0 test with engine disconnected, service braking in accordance with paragraph 2.1.1. (A) of this Annex. The test must be carried out at the speed prescribed, the figures prescribed in this connection being subject to a certain margin of tolerance. The minimum performance prescribed must be attained.	S7.5. S7.5.1. S7.5.2. S7.5.3.	Cold effectiveness. Vehicle conditions. (a) Vehicle load: GVWR and LLVW. (b) Transmission position: In neutral. Test conditions and procedures. (a) IBT: ≧65 ° C (149 ° F), ≦100 ° C (212 ° F). (b) Test speed: 100 km/h (62.1 mph). (c) Pedal force: ≧65N (14.6 lbs), ≦500N (112.4 lbs). (d) Wheel lockup: No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h (9.3 mph). (e) Number of runs: 6 stops. (f) Test surface: PFC of 0.9. S7.5.1. Vehicle conditions. (a) Vehicle load: GVWR and LLVW. (b) Transmission position: In neutral. (g) For each stop, bring the vehicle to test speed and then stop the vehicle in the shortest possible distance under the specified conditions. Performance requirements. (a) Stopping distance for 100 km/h test speed: ≦70m (230 ft). (b) Stopping distance for reduced test speed: $S \leqq 0.10\ V + 0.0060\ V^2$	**C1, P** ・FMVSS：No MFDD is prescribed in MVSS.
1.4.3. 1.4.3.1.	Type-0 test with engine connected, service braking in accordance with paragraph 2.1.1. (B) of this Annex. The test shall be carried out with the engine connected, from the speed prescribed in paragraph 2.1.1. (B) of this Annex. The minimum performance prescribed shall be attained. This test is not run if the maximum speed of the vehicle is ≦125 km/h.	S7.6. S7.6.1. S7.6.2. S7.6.3.	High speed effectiveness. This test is not run if vehicle maximum speed is less than or equal to 125 km/h (77.7 mph). Vehicle conditions. (a) Vehicle load: GVWR and LLVW. (b) Transmission position: In gear. Test conditions and procedures. (a) IBT: ≧65 ° C (149 ° F), ≦100 ° C (212 ° F). (b) Test speed: 80% of vehicle maximum speed if 125 km/h (77.7 mph) < vehicle maximum speed < 200 km/h (124.3 mph), or 160 km/h (99.4 mph) if vehicle maximum speed ≤200 km/h (124.3 mph). (c) Pedal force: ≧65N (14.6 lbs), ≦500N (112.4 lbs). (d) Wheel lockup: No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h (9.3 mph). (e) Number of runs: 6 stops. (f) Test surface: PFC of 0.9. Performance requirements. Stopping distance: $S \leqq 0.10\ V + 0.0067\ V^2$	**C1, P** ・FMVSS：No MFDD is prescribed in MVSS.
1.5	Type-I test			
1.5.1	Heating procedure	S7.13.	Heating Snubs.	
		S7.13.1	**General information.** The purpose of the snubs is to heat up the brakes in preparation for the hot performance test which follows immediately.	**C1**

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1.5.1.1	The service brakes of all vehicles must be tested by successively applying and releasing the brakes a number of times (n), the vehicle being laden, in the conditions shown in the table below: Conditions: v1＝80% vmax but ≦ 120km/h v2＝1/2 v1km/h Δt＝ 45 sec n＝ 15 where: v1 = initial speed, at beginning of braking v2 = speed at end of braking vmax = maximum speed of the vehicle n = number of brake applications Δt = duration of a braking cycle: ie. time elapsing between the initiation of one brake application and the initiation of the next.	S7.13.2. (a)	**Vehicle conditions.** (a) Vehicle load: GVWR only.	C1
		S7.13.3	**Test conditions and procedures.** (b) Number of snubs: 15. (c) Test speeds: The initial speed for each snub is 120 km/h (74.6 mph) or 80% of Vmax, whichever is slower. Each snub is terminated at one-half the initial speed. (e) Pedal force: Adjust as necessary to maintain the specified constant deceleration rate. (h) Immediately after the 15th snub, accelerate to 100 km/h (62.1 mph) and commence the hot performance test.	
	N.A.	S7.13.3(a)、(1)、(2)	(a) IBT: (1) Establish an IBT before the first brake application (snub) of ≧ 55° C (131° F), ≦ 65° C (149° F). (2) IBT before subsequent snubs are those occurring at the distance intervals.	C1
1.5.1.2 1.5.1.2 (R768)	If the characteristics of the vehicle make it impossible to abide by the duration prescribed for Δt , the duration may be increased; 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	S7.13.3.,(f)	Time interval: Maintain an interval of 45 seconds between the start of brake applications (snubs).	P No prescription for not to achieve the initial speed prescribed within the interval.
1.5.1.3	to attain a mean deceleration of 3 m/s^2	S7.13.3.,(d),(1)	Maintain a constant deceleration rate of 3.0 m/s^2 (9.8 fps^2).	C3 mean decel vs. constant decel
		S7.13.3.,(d),(2)	Attain the specified deceleration within one second and maintain it for the remainder of the snub.	
1.5.1.3	2 preliminary tests may be carried out to determine the appropriate control force.		N.A.	C3
1.5.1.4	During brake applications, the highest gear ratio (excluding overdrive, etc.) must be continuously engaged.	S7.13.2.,(b)	Transmission position: In gear.	C1
		S6.5.5.2.	For tests in gear, a stop or snub is made in accordance with the following procedures:	
		S6.5.5.2.,(a)	With the transmission selector in the control position recommended by the manufacturer for driving on a level surface at the applicable test speed, exceed the test speed by 6 to 12 km/h (3.7 to 7.5 mph);	
		S6.5.5.2.,(b)	Close the throttle and coast in gear; and	
		S6.5.5.2.,(c)	When the test speed is reached apply the brakes.	
		S6.5.5.3.,(d)	To avoid engine stall, a manual transmission may be shifted to neutral (or the clutch disengaged) when the vehicle speed is below 30 km/h (18.6 mph).	
1.5.1.5	For regaining speed after braking, the gearbox must be used in such a way as to attain the speed v1 in the shortest possible time (maximum acceleration allowed by the engine and gearbox).	S7.13.3.,(g)	Accelerate as rapidly as possible to the initial test speed immediately after each snub.	O2

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1.5.1.6	For vehicles not having sufficient autonomy to carry out the cycles of heating of the brakes, the tests shall be carried out by achieving the prescribed speed before the first braking application and thereafter by using the maximum acceleration available to regain speed and then braking successively at the speed reached at the end of each 45 second cycle duration.	S6.3.11.3	At the beginning of each performance test in the test sequence (S7.2. through S7.17. of this standard), unless otherwise specified, an EV's propulsion batteries are at the state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95%. No further charging of any propulsion battery occurs during any of the performance tests in the test sequence of this standard. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge brake warning lamp is illuminated, the vehicle is to be accelerated to brake test speed by auxiliary means. If a battery is replaced rather than recharged, the replacement battery shall be charged and measured for state of charge in accordance with these procedures.	**P,TE** ECE permits test speed decreasing in heating cycle exept the first braking. FMVSS requires to achieve the prescribed speed by using other means.
1.5.1.7	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 such that the braking force contribution provided by the electric regenerative braking system does not exceed the minimum guaranteed by the system design. This requirement is deemed to be satisfied if the batteries are at one of the state of charge conditions as listed in paragraph 1.4.1.2.3. above.	S6.3.11.3	At the beginning of each performance test in the test sequence (S7.2. through S7.17. of this standard), unless otherwise specified, an EV's propulsion batteries are at the state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95%. No further charging of any propulsion battery occurs during any of the performance tests in the test sequence of this standard. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge brake warning lamp is illuminated, the vehicle is to be accelerated to brake test speed by auxiliary means. If a battery is replaced rather than recharged, the replacement battery shall be charged and measured for state of charge in accordance with these procedures.	**P,T** condition of the vehicle batteries at the start of test
1.5.2	Hot performance	S7.14	Hot performance.	
	N.A.	S7.14.1	**General information.** The hot performance test is conducted immediately after completion of the 15th heating snub.	**C1**
	N.A.	S7.14.2(a)	**Vehicle conditions.** Vehicle load: GVWR only.	**C1**
1.5.2.1	At the end of the Type-I test (described in paragraph 1.5.1. of this Annex) the hot performance of the service braking system must be measured in the same conditions (and in particular at a mean 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).	S7.14.2(b)	Transmission position: In neutral.	**C1**
		S7.14.3	**Test conditions and procedures.** (a) IBT: Temperature achieved at completion of heating snubs. (b) Test speed: 100 km/h (62.1 mph). (c) Pedal force: (1) The first stop is done with an average pedal force not greater than the average pedal force recorded during the shortest GVWR cold effectiveness stop. (d) Wheel lockup: No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h (9.3 mph). (f) Immediately after the 15th heating snub, accelerate to 100 km/h (62.1 mph) and commence the first stop of the hot performance test. (g) If the vehicle is incapable of attaining 100 km/h, it is tested at the same speed used for the GVWR cold effectiveness test. (i) Immediately after completion of the second hot performance stop, drive 1.5km (0.93 mi) at 50 km/h (31.1 mph) before the first cooling stop.	**C1**
1.5.2.2	This hot performance must not be less than 75% 2/ of that prescribed, nor less than 60% of the figure recorded in the Type-0 test with the engine disconnected.	S7.14.4(a)	**Performance requirements.** For the first hot stop, the stopping distance must be less than or equal to a calculated distance which is based on 60 % of the deceleration actually achieved on the shortest GVWR cold effectiveness stop. The following equations shall be used in calculating the performance requirement:	**C1**

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			$S=0.10V+\frac{0.0386V^2}{0.06(d_c)}$ $d_c=\frac{0.0386V^2}{S_c-0.10V}$ where, d_c = theaverage deceleration actually achieved during the shortest cold effectiveness stop at GVWR (m/s^2), S_c = actual stopping distance measured on the shortest cold effectiveness stop at GVWR (m), and V = cold effectiveness test speed (km/h).	
		S7.14.4(b)	In addition to the requirement in S7.14.4.(a), the stopping distance for at least one of the two hot stops must be S ≦ 89 m (292 ft) from a test speed of 100 km/h (62.1 mph) or, for reduced test speed, S ≦ 0.10 V + 0.0079 V^2. The results of the second stop may not be used to meet the requirements of S7.14.4.(a)	
1.5.2.4	In the case of vehicles equipped with an electric regenerative braking system of category B, having carried out the heating cycles according to paragraph 1.5.1.6. of this Annex, the hot performance test shall be carried out at the maximum speed which can be reached by the vehicle at the end of the brake heating cycles, unless the speed specified in paragraph 2.1.1.(A) of this Annex can be reached. For comparison, a later Type-0 test with cold brakes shall be repeated from this same speed and with a similar electric regenerative braking contribution, as set by an appropriate state of battery charge, as was available during the hot performance test. Following the recovery process and test, further reconditioning of the linings shall be permitted before the test is made to compare this second cold performance with that achieved in the hot test, against the criteria of paragraphs 1.5.2.2. or 1.5.2.5. of this Annex."	S6.3.11.3.	At the beginning of each performance test in the test sequence (S7.2. through S7.17. of this standard), unless otherwise specified, an EV's propulsion batteries are at the state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95%. No further charging of any propulsion battery occurs during any of the performance tests in the test sequence of this standard. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge brake warning lamp is illuminated, the vehicle is to be accelerated to brake test speed by auxiliary means. If a battery is replaced rather than recharged, the replacement battery shall be charged and measured for state of charge in accordance with these procedures.	**P,TE** ECE permits test speed decreasing in heating cycle exept the first braking. FMVSS requires to achieve the prescribed speed by using other means.
1.5.2.5	specified in paragraph 1.5.2.2. of this Annex, but which cannot comply with the 75% [2/] requirement of paragraph 1.5.2.2. of this Annex, a further hot performance test may be carried out using a control force not exceeding that specified in paragraph 2. of this Annex.	S7.14.3.(c),(2)	The second stop is done with a pedal force not greater than 500 N (112.4 lbs).	
	N.A.	S7.14.3.(e)	Number of runs: 2 stops.	**C2** The second hot performans braking should be carried out in FMVSS.
	N.A.	S7.14.3.(h)	Immediately after completion of the first hot performance stop, accelerate as rapidly as possible to the specfied test speed and conduct the second hot performance stop.	
	N.A.	S7.14.4.(b)	The results of the second stop may not be used to meet the requirements of S7.14.4(a).	
		S7.15	Brake cooling stops.	
1.5.3	**Recovery procedure** Immediately after the hot performance test, make four 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.	S7.15.1.	**General information.** The cooling stops are conducted immediately after completion of the hot performance test. (a) Vehicle load: GVWR only. (b) Transmission position: In gear.	**C1,C3** mean decel vs. constant decel

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		S7.15.3.	**Test conditions and procedures** .(a) IBT: Temperature achieved at completion of hot performance. (b) Test speed: 50 km/h (31.1 mph). (c) Pedal force: Adjust as necessary to maintain specified constant deceleration rate. (d) Deceleration rate: Maintain a constant deceleration rate of 3.0 m/s^2 ($9.8fps^2$). (e) Wheel lockup: No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h (9.3 mph). (g) Immediately after the hot performance stops drive 1.5 km (0.93 mi) at 50km/h (31.1(31.1 mph) before the first cooling stop. (h) For the first through the third cooling stops: (1) After each stop, immediately accelerate at the maximum rate to 50 km/h(31.1 mph). (2) Maintain that speed until beginning the next stop at a distance of 1.5 km (0.93mi) from the beginning of the previous stop. (i) For the fourth cooling stop: (1) Immediately after the fourth stop, accelerate at the maximum rate to 100km/h (62.1 mph). (2) Maintain that speed until beginning the recovery performance stops at a distance of 1.5km (0.93mi) after the beginning of the fourth cooling stop.	**C1** **C1**
1.5.4	**Recovery performance** 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 that mean control force used in the corresponding Type-0 test. 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.	S7.16.2.	Vehicle conditions. (a) Vehicle load: GVWR only. (b) Transmission position: In neutral.	**C1**
		S7.16.3.	**Test conditions and procedures.** (a) IBT: Temperature achieved at completion of cooling stops. (b) Test speed: 100 km/h (62.1 mph). (c) Pedal force: The average pedal force shall not be greater than the average pedal force recorded during the shortest GVWR cold effectiveness stop. (d) Wheel lockup: No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h (9.3 mph). (f) Immediately after the fourth cooling stop, accelerate at the maximum rate to 100 km/h (62.1 mph). (g) Maintain that speed until beginning the first recovery performance stop at a distance of 1.5 km (0.93 mi) after the beginning of the fourth cooling stop. (h) If the vehicle is incapable of attaining 100 km/h, it is tested at the same speed used for the GVWR cold effectiveness test.	**C1**
		S7.16.4.	**Performance requirements.** The stopping distance, S, for at least one of the two stops must be within the following limits: $\frac{0.0386V^2}{0.70d} \leqq S-0.10V \leqq \frac{0.0386V^2}{1.50d}$ where dc and V are defined in S7.14.4.(a).	
	N.A.	S7.15.3.(i),(2)	Maintain that speed until beginning a distance of 1.5 km (0.93 mi) after the beginning of the fourth cooling stop.	**C1,C2** The second recovery braking should be carried out
	N.A.	S7.16.3.(e)	Number of runs: 2 stops.	
	N.A.	S7.16.3.(i)	Immediately after completion of the first recovery performance stop accelerate as rapidly as possible to the specified test speed and conduct the second recovery performance stop.	

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1.5.4.1	For vehicles equipped with an electrical regenerative braking system of category B, the recovery test shall be made with no regenerative braking component, i.e. under the conditions of paragraph 1.5.4. above. After the further reconditioning of the linings, a second repeat Type-0 test shall be made from the same speed and with no electric regenerative braking contribution as in the recovery test with the engine/motors disconnected, and comparison shall be made between these test results. The recovery performance must not be less than 70%, nor more than 150% of the figure recorded in this final repeat Type-0 test."		N.A.	**P,TE** ECE permits test speed decreasing in recovery perfomance test. FMVSS requires to achieve the prescribed speed.
2	PERFORMANCE OF BRAKING SYSTEM			
2.1.2	In the case of a motor vehicle authorized to tow an unbraked trailer, the minimum Type-0 performance of the combination shall be not less than 5.4 m/s^2 in both the laden and unladen conditions. The combination performance shall be verified by calculations referring to the maximum braking performance actually achieved by the motor vehicle alone (laden) during the Type-0 test with the engine disconnected, using the following formula (no practical tests with a coupled unbraked traier are required): $d_{M+R}=d_M \frac{P_M}{P_M+P_R}$ dM+R=dM・ PM/(PM+PR) where: d_{M+R} = calculated mean fully developed deceleration of the motor vehicle when coupled to an unbraked trailer, in m/s^2 d_M = maximum mean fully developed deceleration of the motor vehicle alone achieved during the Type-0 test with engine disconnected, in m/s^2 P_M = mass of the motor vehicle (laden) P_R = maximum mass of an unbraked trailer which may be coupled, as declared by the motor vehicle manufacturer.		N.A.	**P** unbraked trailer
1.4.1.2.1	the vehicle must be laden, 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 mass on each axle is proportional to the maximum permissible mass for each axle;	S7.10.2(a)	**Hydraulic circuit failure.** Vehicle conditions. Vehicle load: LLVW and GVWR.	**C1、C3** Non split service brake system is permitted in FMVSS135. Only GVWR is required in brake power unit or brake power assist unit inoperative test of FMVSS135.
1.4.1.2.2	every test must be repeated on the unladen vehicle; there may be, inaddition to the driver, a second person on the front seat who is responsible for noting the results of the test;	S7.11.2(a)	**Brake power unit or brake power assist unit inoperative (System depleted).** Vehicle conditions Vehicle load: GVWR only.	
2.2.1	The performance of the secondary braking system shall be tested by the Type-0 test with the engine disconnected from an initial vehicle speed of 100 km/h and a force applied to the service brake control of not less than 6.5 daN and not exceeding 50 daN.	S7.10.3(a)、(b)、(c) S7.11.3(a)、(b)、(c)	**Hydraulic circuit failure/Brake power unit or brake power assist unit inoperative (System depleted).** Test conditions and procedures. IBT: ≧ 65° C (149° F), ≦ 100° C (212° F). Test speed: 100 km/h (62.1 mph). Pedal force: ≧ 65 N (14.6 lbs), ≦ 500 N (112.4 lbs).	**C1**
		S7.10.2(b)、S7.11.2(b)	Transmission position: In neutral.	**C1**

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1.2.7	the prescribed performance must be obtained without locking of the wheels at speeds exceeding 15 km/h, without deviation of the vehicle, from a 3.5 m wide lane, without exceeding a yaw angle of 15° , and without abnormal vibrations;	S7.10.3(d) 、 S7.11.3(d)	**Hydraulic circuit failure/Brake power unit or brake power assist unit inoperative (System depleted).** Wheel lockup: No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h (9.3 mph).	C1
1.2.4	the road must have a surface affording good adhesion, unless specified otherwise in the relevant annexes;	S7.10.3(e) 、 S7.11.3(f)	**Hydraulic circuit failure/Brake power unit or brake power assist unit inoperative (System depleted).** Test surface: PFC of 0.9.	C1
1.4.1.2.5	the road must be level; unless otherwise specified each test may comprise up to 6 stops including any needed for familiarization.	S7.10.3(h)	Number of runs: After the brake warning indicator has been activated, make the following stops depending on the type of brake system: (1) 4 stops for a split service brake system. (2) 10 consecutive stops for a non-split service brake system.	C1,P 4 runs are prescribed in FMVSS instead of 6 in ECE.
		S7.10.3(i)	**Hydraulic circuit failure** Each stop is made by a continuous application of the service brake control.	C1
	N.A.	S7.10.3(j)	Restore the service brake system to normal at the completion of this test.	C1
	N.A.	S7.10.3(k)	Repeat the entire sequence for each of the other subsystems.	C1
1.4.1.2.5	the road must be level; unless otherwise specified each test may comprise up to 6 stops including any needed for familiarization.	S7.11.3(e)	**Brake power unit or brake power assist unit inoperative (System depleted)** Number of runs: 6 stops.	C1
		S7.11.3(j)	Make each of the 6 stops by a continuous application of the service brake	
	N.A.	S7.11.3(k)	Restore the system to normal at completion of this test.	C1
	N.A.	S7.11.3(l)	For vehicles equipped with more than one brake power unit or brake power assist unit, conduct tests for each in turn.	C1
	N.A.	S7.11.3(m)	For vehicles with electrically-actuated service brakes (brake power unit), this test is conducted with any single electrical failure in the electrically-actuated service brakes instead of a failure of any other brake power or brake power assist unit, and all other systems intact.	C1
2.2.2	The secondary braking system must give a stopping distance not exceeding the following value: $0.1v + 0.0158 v^2$ (m) and a mean fully developed deceleration not less than 2.44 m/s^2 (corresponding to the second term of the above formula).	S7.10.4	**Hydraulic circuit failure.** For vehicles manufactured with a split service brake system, in the event of any failure in a single subsystem, as specified in S7.10.3.(f) of this standard, and after activation of the brake system indicator as specified in S5.5.1., the remaining portions of the service brake system shall continue to operate and shall stop the vehicle as specified in S7.10.4.(a) or S7.10.4.(b). For vehicles not manufactured with a split service brake system, in the event of any failure in any component of the service brake system as specified in S7.10.3.(f), and after activation of the brake system indicator as specified in S5.5.1. of this standard, the vehicle shall by operation of the service brake control stop 10 times consecutively as specified in S7.10.4.(a) or S7.10.4.(b). (a) Stopping distance from 100 km/h test speed: ≦168 m (551 ft). .	P No MFDD is prescribed in MVSS.
		S7.11.4	**Brake power unit or brake power assist unit inoperative (System depleted).** The service brakes on a vehicle equipped with one or more brake power assist units or brake power units, with one such unit inoperative and depleted of all reserve capability, shall stop the vehicle as specified in S7.11.4.(a) or S7.11.4.(b). (a) Stopping distance from 100 km/h test speed: ≦168 m (551 ft). (b) Stopping distance for reduced test speed: $S \leqq 0.10 V + 0.0158V^2$.	P No MFDD is prescribed in MVSS.
2.2.3	The secondary braking effectiveness test shall be conducted by simulating the actual failure conditions in the service braking system.	S7.10.3(f)	**Hydraulic circuit failure.** Alter the service brake system to produce any single failure. For a hydraulic circuit, this may be any single rupture or leakage type failure, other than a structural failure of a housing that is common to two or more sub-systems.	
		S7.10.3(g)	Determine the control force pressure level or fluid level (as appropriate for the indicator being tested) necessary to activate the brake warning indicator.	

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		S7.11.3(g)	**Brake power unit or brake power assist unit inoperative (System depleted).** Disconnect the primary source of power for one brake power assist unit or brake power unit, or one of the brake power unit or brake power assist unit subsystems if two or more subsystems are provided.	**C1**
5.2.5	The requirements of paragraphs 5.2.2.,5.2.3. and 5.2.4. above must be met without the use of any automatic device of a kind such that its ineffectiveness might pass unnoticed through the fact that parts normally in a position of rest come into action only in the event of failure in the braking system.	S7.11.3(h)	If the brake power unit or power assist unit operates in conjunction with a backup system and the backup system is automatically activated in the event of a primary power service failure, the backup system is operative during this test.	**TBD** item to discuss.
		S7.11.3(i)	Exhaust any residual brake power reserve capability of the disconnected	**C1**
2.2.4	For vehicles employing electric regenerative braking systems, the braking performance shall additionally be checked under the two following failure conditions:		N.A.	**C2**
2.2.4.1	For a total failure of the electric component of the service braking output.		N.A.	**C2**
2.2.4.2	In the case where the failure condition causes the electric component to deliver its maximum braking force.		N.A.	**C2**
2.3	Parking braking system			
2.3.2	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.		N.A.	**P**
	N.A.	S7.12.1.(b)	Transmission position: In neutral.	**C1**
	N.A.	S7.12.1.(c),(1)	For vehicles with parking brake systems not utilizing the service friction elements, the friction elements of such a system are burnished prior to the parking brake test according to the published recommendations furnished to the purchaser by the manufacturer.	**C1**
	N.A.	S7.12.1.(c),(2)	If no recommendations are furnished, the vehicle's parking brake system is tested in an unburnished condition.	**C1**
	N.A.	S7.12.1.(d)	Parking brake applications: 1 application and up to 2 reapplications, if necessary.	**C1**
	N.A.	S7.12.2.(a),(1)	Parking brake systems utilizing service brake friction materials shall be tested with the IBT ≦ 100° C (212° F) and shall have no additional burnishing or artificial heating prior to the start of the parking brake test.	**C1**
	N.A.	S7.12.2.(a),(2)	Parking brake systems utilizing nonservice brake friction materials shall be tested with the friction materials at ambient temperature at the start of the test. The friction materials shall have no additional burnishing or artificial heating prior to or during the parking brake test.	**C1**
	N.A.	S7.12.2.(c)	Hand force measurement locations: The force required for actuation of a hand-operated brake system is measured at the center of the hand grip area or at a distance of 40 mm (1.57 in) from the end of the actuation lever as illustrated in Figure 3.	**C1**
2.3.5	A parking braking system which has to be actuated several times before it attains the prescribed performance	S7.12.2.(d)	Parking brake applications: 1 application and up to 2 reapplications, if necessary.	**C1**
	is admissible.	S7.12.2.(j)	In the case of a parking brake system that does not allow application of the specified force in a single application, a series of applications may be made to achieve the specified force.	**C1**
	N.A.	S7.12.2.(f)	Drive the vehicle onto the grade with the longitudinal axis of the vehicle in the direction of the slope of the grade.	**C1**
	N.A.	S7.12.2.(g)	Stop the vehicle and hold it stationary by applying the service brake control and place the transmission in neutral.	**C1**
	N.A.	S7.12.2.(h)	With the service brake applied sufficiently to just keep the vehicle from rolling, apply the parking brake as specified in S7.12.2(i) or S7.12.2(j).	**C1**

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	N.A.	S7.12.2.(i)	For a vehicle equipped with mechanically-applied parking brakes, make a single application of the parking brake control with a force not exceeding the limits specified in S7.12.2.(b). For a vehicle using an electrically-activated parking brake, apply the parking brake by activating the parking brake control.	C1
	N.A.	S7.12.2.(k)	Following the application of the parking brakes, release all force on the service brake control and, if the vehicle remains stationary, start the measurement of time.	C1
	N.A.	S7.12.2.(l)	If the vehicle does not remain stationary, reapplication of a force to the parking brake control at the level specified in S7.12.2(b) as appropriate for the vehicle being tested (without release of the ratcheting or other holding mechanism of the parking brake) is used up to two times to attain a stationary position.	C1
	N.A.	S7.12.2.(m)	Verify the operation of the parking brake application indicator.	C1
	N.A.	S7.12.2.(n)	Following observation of the vehicle in a stationary condition for the specified time in one direction, repeat the same test procedure with the vehicle orientation in the opposite direction on the same grade.	C1
	N.A.	S7.12.3.	The parking brake system shall hold the vehicle stationary for 5 minutes in both a forward and reverse direction on the grade.	C1
2.3.6	To check compliance with the requirement specified in paragraph 5.2.2.4. of this Regulation, a Type-0 test must be carried out, with the engine disconnected, at an initial test speed of 30 km/h. 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/s^2 . The test shall be carried out with the laden vehicle. The force exerted on the braking control device shall not exceed the specified values.		N.A.	P Dynamic PKB
3	RESPONSE TIME			
3.1.	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:		N.A.	P Braking system with stored energy
3.1.1.	in an emergency manoeuvre, 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 ;		N.A.	P
3.1.2.	in the case of vehicles fitted with hydraulic braking systems, the requirements of paragraph 3.1.1. 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 .		N.A.	P
Annex4	PROVISIONS RELATING TO ENERGY SOURCES AND ENERGY STORAGE DEVICES (ENERGY ACCUMULATORS) HYDRAULIC BRAKING SYSTEMS WITH STORED ENERGY 1. CAPACITY OF ENERGY STORAGE DEVICES (ENERGY ACCUMULATORS). 2. CAPACITY OF HYDRAULIC FLUID ENERGY SOURCES. 3. CHARACTERISTICS OF WARNING DEVICES.		N,A.	TE
Annex5	DISTRIBUTION OF BRAKING AMONG THE AXLES OF VEHICLES			
1.	GENERAL. Vehicles which are not equipped with an anti-lock system as defined in Annex 6 to this Regulation shall meet all the requirements of this Annex. If a special device is used, this must operate automatically.	S7.2.1.(b)	This test is for vehicles without antilock brake systems. results of this test.	O2 The special device to meet the requirement of Annex5 must operate automatically.

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Paragraph	Contents	Paragraph	Contents	
3.1.(B)	For k values between 0.2 and 0.8 : $z \geqq 0.1 + 0.7 (k - 0.2)$ (see diagram 1 of this Annex)		N.A.	**C2, P**
3.2.	In order to verify the requirements of paragraph 3.1. of this Annex, the manufacturer shall provide the adhesion utilization curves for the front and rear axles calculated by the formulae: The curves shall be plotted for both the following load conditions:		N.A.	**C2**
3.2.1.	unladen, in running order with the driver on board ;	S4.	N.A.	**C2**
3.2.2.	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 ;	S6.3.1.1.	N.A.	**C2**
4.	REQUIREMENTS TO BE MET IN CASE OF FAILURE OF THE BRAKING DISTRIBUTION SYSTEM. When the requirements of this Annex 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 to give a stopping distance not exceeding $0.1v + 0.0100 v^2$ (m) and a mean fully developed deceleration not less than 3.86 m/s^2.	S7.9.3.	The service brakes on a vehicle equipped with one or more variable brake proportioning systems, in the event of any single functional failure in any such system, shall continue to operate and shall stop the vehicle as specified in S7.9.3(a) or S7.9.3(b). (a) Stopping distance for 100 km/h test speed: ≤ 110 m (361 ft). (b) Stopping distance for reduced test speed: S ≤0.10V + 0.0100V2.	**P** No MFDD is prescribed in MVSS.
6.	CONFORMITY OF PRODUCTION.			
6.1.	When checking vehicles for conformity of production, the Technical Services should follow the same procedures as for Type-Approval.		N.A.	**C3**
6.2.	The requirements shall also be the same as for Type-Approval, except that in the test described in paragraph 5.2.(a)(ii), the rear axle curve must lie below the line z = 0.9 k for all braking rates between 0.15 and 0.8 (instead of meeting the requirement in paragraph 3.1.(A) (see diagram 2).		N.A.	**C3**
Annex6	TEST REQUIREMENTS FOR VEHICLES FITTED WITH ANTI-LOCK SYSTEMS	S7.3.	ABS performance. [Reserved]	**P**
2.2.	"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.		N.A.	**—**
2.3.	"Controller" means a component designed to evaluate the data transmitted by the sensor(s) and to transmit a signal to the modulator.		N.A.	**—**
2.4.	"Modulator" means a component designed to vary the braking force(s) in accordance with the signal received from the controller.		N.A.	**—**
2.5.	"Directly controlled wheel" means a wheel whose braking force is modulated according to data provided at least by its own sensor.		N.A.	**—**
2.6.	"Indirectly controlled wheel" means a wheel whose braking force is modulated according to data provided by the sensor(s) of other wheel(s).		N.A.	**—**
2.7.	"Full cycling" means that the anti-lock 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.		N.A.	**—**
3.	TYPES OF ANTI-LOCK SYSTEM.		N.A.	**—**

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Paragraph	Contents	Paragraph	Contents	
4.1.	Any electrical failure or sensor anomaly that affects the system with respect to the functional and performance requirements in this Annex, 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 in paragraph 5.2.21.1.2. of this Annex shall be used for this purpose.		N.A.	—
4.1.1.	Sensor anomalies, which cannot be deleted 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/h.		N.A.	—
4.1.2.	When the anti-lock braking system is energized with the vehicle stationary, electrically controlled pneumatic modulator valve(s) shall cycle at least once.		N.A.	—
4.2.	In the event of a single electrical functional failure which only affects the anti-lock function, as indicated by the above-mentioned yellow warning signal, the subsequent service braking performance must not be less than 80% of the prescribed performance according to the Type-0 test with the engine disconnected. This corresponds to a stopping distance of 0.1v + 0.0075 v^2 (m) and a mean fully developed deceleration of 5.15 m/s^2.	S7.8. S7.8.1.	Antilock functional failure. Vehicle conditions. (a) Vehicle loading: LLVW and GVWR. (b) Transmission position: In neutral.	C1
		S7.8.2.	Test conditions and procedures. (a) IBT: d65 ° C (149 ° F), d100 ° C (212 ° F). (b) Test speed: 100 km/h (62.1 mph). (c) Pedal force: d 65 N (14.6 lbs), d 500 N (112.4 lbs). (d) Wheel lockup: No lockup of any wheel for more than 0.1 seconds allowed at speeds greater than 15 km/h(9.3 mph). (e) Number of runs: 6 stops. (f) Test surface: PFC of 0.9. (g) Functional failure simulation: (1) Disconnect the functional power source, or any other electrical connector that creates a functional failure. (2) Determine whether the brake system indicator is activated when any electrical functional failure of the antilock system is created. (3) Restore the system to normal at the completion of this test. (h) If more than one antilock brake subsystem is provided, repeat test for each subsystem.	C1
		S7.8.3.	Performance requirements. For service brakes on a vehicle equipped with one or more antilock systems, in the event of any single functional failure in any such system, the service brake system shall continue to operate and shall stop the vehicle as specified in S7.8.3(a) or S7.8.3(b). (a) Stopping distance for 100 km/h test speed: ≤ 85 m (279 ft). (b) Stopping distance for reduced test speed: S ≤ 0.10V + 0.0075V2.	P No MFDD is prescribed in MVSS.
4.3.	The operation of the anti-lock system must not be adversely affected by magnetic or electric fields. This shall be demonstrated by compliance with Regulation No. 10, 02 series of amendments.		N.A.	P
5.	SPECIAL PROVISIONS.			
5.1.	Energy consumption		N.A.	—
5.2.	Utilization of Adhesion		N.A.	—
5.3.	Additional checks		N.A.	—
Annex6 Appendix 1	SYMBOLS AND DEFINITIONS		N.A.	—

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Paragraph	Contents	Paragraph	Contents	
Annex6 Appendix 2	UTILIZATION OF ADHESION		N.A.	–
Annex6 Appendix 3	PERFORMANCE ON DIFFERING ADHESION SURFACES		N.A.	–
Annex6 Appendix 4	METHOD OF SELECTION OF THE LOW ADHESION SURFACE		N.A.	–
Annex7	INERTIA DYNAMOMETER TEST METHOD FOR BRAKE LININGS		N.A.	C3
Annex8	SPECIAL REQUIREMENTS TO BE APPLIED TO THE SAFETY ASPECTS OF COMPLEX ELECTRONIC VEHICLE CONTROL SYSTEMS		N.A.	T, C2
	N.A.	S4.	**Brake power assist unit** A device installed in a hydraulic brake system that reduces the amount of muscular force that a driver must apply to actuate the system, and that, if inoperative, does not prevent the driver from braking the vehicle by a continued application of muscular force on the service brake control.	C1
2.17.	"Electric regenerative braking" means a braking system which, during deceleration, provides for the conversion of vehicle kinetic energy into electrical energy.	S4.	**Electric vehicle or EV**. A motor vehicle that is powered by an electric motor drawing current from rechargeable storage batteries, fuel cells, or other portable sources of electrical current, and which may include a non electrical source of power designed to charge batteries and components thereof.	T, TE, C1
	N.A.	S4.	**Functional failure.** A failure of a component (either electrical or mechanical in nature) which renders the system totally or partially inoperative yet the structural integrity of the system is maintained.	C1
	N.A.	S4.	**Lightly loaded vehicle weight or LLVW.** Unloaded vehicle weight plus the weight of a mass of 180 kg (396 pounds), including driver and instrumentation.	C1
		S4.	**Maximum speed of a vehicle or Vmax.** The highest speed attainable by accelerating at a maximum rate from a standing start for a distance of 3.2 km (2 miles) on a level surface, with the vehicle at its lightly loaded vehicle weight, and, if an EV, with the propulsion batteries at a state of charge of not less than 95 percent at the beginning of the run.	C1
		S4.	**Objective brake factor.** The arithmetic average of all the brake factors measured over the twenty brake applications defined in S7.4, for all wheel positions having a given brake configuration.	C1
	N.A.	S4.	**Peak friction coefficient or PFC.** The ratio of the maximum value of braking test wheel longitudinal force to the simultaneous vertical force occurring prior to wheel lockup, as the braking torque is progressively increased.	C1
	N.A.	S4.	**Pressure component.** A brake system component that contains the brake system fluid and controls or senses the fluid pressure.	C1
	N.A.	S4.	**Snub.** The braking deceleration of a vehicle from a higher reference speed to a lower reference speed that is greater than zero.	C1
	N.A.	S4.	**Split service brake system.** A brake system consisting of two or more subsystems actuated by a single control, designed so that a single failure in any subsystem (such as a leakage-type failure of a pressure component of a hydraulic subsystem except structural failure of a housing that is common to two or more subsystems, or an electrical failure in an electric subsystem) does not impair the operation of any other subsystem.	C1

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Paragraph	Contents	Paragraph	Contents	
	N.A.	S4.	**Variable brake proportioning system.** A system that has one or more proportioning devices which automatically change the brake pressure ratio between any two or more wheels to compensate for changes in wheel loading due to static load changes and/or dynamic weight transfer, or due to deceleration.	C1
	N.A.	S4.	**Wheel lockup.** 100 percent wheel slip.	C1
	N.A.	S5.4.1.	**Master cylinder reservoir** A master cylinder shall have a reservoir compartment for each service brake subsystem serviced by the master cylinder. Loss of fluid from one compartment shall not result in a complete loss of brake fluid from another compartment.	P
	N.A.	S5.5.5 (b)	(b) Vehicles manufactured with a split service brake system may use a common brake warning indicator to indicate two or more of the functions described in S5.5.1(a) through S5.5.1(d). If a common indicator is used, it shall display the word ''Brake.''	P
	N.A.	S5.5.5 (c)	(c) A vehicle manufactured without a split service brake system shall use a separate indicator to indicate the failure condition in S5.5.1(a). This indicator shall display the words ''STOP— BRAKE FAILURE'' in block capital letters not less than 6.4 mm (1/4 inch) in height	P
	N.A. N.A. N.A. N.A. N.A. N.A. N.A. N.A.	S5.5.5 (d)	(d) If separate indicators are used for one or more of the conditions described in S5.5.1(a) through S5.5.1(g), the indicators shall display the following wording: (1) If a separate indicator is provided for the low brake fluid condition in S5.5.1(a)(1), the words ''Brake Fluid'' shall be used except for vehicles using hydraulic system mineral .. (2) If a separate indicator is provided for the gross loss of pressure condition in S5.5.1(a)(2), the words ''Brake Pressure'' shall be used. (3) If a separate indicator is provided for the condition specified in S5.5.1(b), the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled with the words ''Antilock'' or ''Anti-lock'' or ''ABS''; or ''Brake Proportioning,'' in accordance with Table 2 of Standard No. 101. (4) If a separate indicator is provided for application of the parking brake as specified for S5.5.1(c), the single word ''Park'' or the words ''Parking Brake'' may be used. (5) If a separate indicator is provided to indicate brake lining wear-out as specified in S5.5.1(d), the words ''Brake Wear'' shall be used. (6) If a separate indicator is provided for the condition specified in S5.5.1(g), the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled with the symbol ''RBS.'' RBS failure in a system that is part of the service brake system may also be indicated by a yellow lamp that also indicates ''ABS'' failure and displays the symbol ''ABS/ RBS'' (7) If a separate indicator is provided for any other function, the display shall include the word ''Brake'' and the appropriate additional labeling.	P
	N.A.	S6.1.1.	**Ambient temperature.** The ambient temperature is any temperature between 0 ° C (32 ° F) and 40 ° C (104 ° F).	C1
	N.A.	S6.2.1.	**Pavement friction.** Unless otherwise specified, the road test surface produces a peak friction coefficient (PFC) of 0.9 when measured using an American Society for Testing and Materials (ASTM) E1136 standard reference test tire, in accordance with ASTM Method E 1337-90, at a speed of 64.4 km/h (40 mph), without water delivery.	C1
	N.A.	S6.3.2.	**Fuel tank loading.** The fuel tank is filled to 100% of capacity at the beginning of testing and may not be less than 75% of capacity during any part of the testing.	C1
	N.A.	S6.3.3.	**Lining preparation.** At the beginning of preparation for the road tests, the brakes of the vehicle are in the same condition as when the vehicle was manufactured. No burnishing or other special preparation is allowed, unless all vehicles sold to the public are similarly prepared as a part of the manufacturing process.	C1

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	N.A.	S6.3.4.	**Adjustments and repairs.** These requirements must be met without replacing any brake system parts or making any adjustments to the brake system except as specified in this standard. Where brake adjustments are specified (S7.1.3), adjust the brakes, including the parking brakes, in accordance with the manufacturer's recommendation. No brake adjustments are allowed during or between subsequent tests in the test sequence.	**C1**
	N.A.	S6.3.5.	**Automatic brake adjusters.** Automatic adjusters are operational throughout the entire test sequence. They may be adjusted either manually or by other means, as recommended by the manufacturer, only prior to the beginning of the road test sequence.	**C1**
	N.A.	S6.3.6.	**Antilock brake system (ABS).** If a car is equipped with an ABS, the ABS is fully operational for all tests, except where specified in the following sections.	**C1**
	N.A.	S6.3.7.	**Variable brake proportioning valve.** If a car is equipped with a variable brake proportioning system, the proportioning valve is fully operational for all tests except the test for failed variable brake proportioning	**C1**
	N.A.	S6.3.9.	**Engine.** Engine idle speed and ignition timing are set according to the manufacturer's recommendations. If the vehicle is equipped with an adjustable engine speed governor, it is adjusted according to the manufacturer's recommendations.	**C1**
	N.A.	S6.3.10.	**Vehicle openings.** All vehicle openings (doors, windows, hood, trunk, convertible top, cargo doors, etc.) are closed except as required for instrumentation purposes.	**C1**
		S6.3.11	***State of charge of batteries for EV's***	
	N.A.	S6.3.11.2	At the beginning of the burnish procedure (S7.1. of this standard) in the test sequence, each propulsion battery is at the maximum state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, of, if the manufacturer has made no recommendation, not less than 95%. During the 200-stop burnish procedure, the propulsion batteries are restored to the maximum state of charge determined as above, after each increment of 40 burnish stops until the burnish procedure is complete. The batteries may be charged at a more frequent interval during a particular 40-stop increment only if the EV is incapable of achieving the initial burnish test speed during that increment. During the burnish procedure, the propulsion batteries may be charged by external means or replaced by batteries that are at a state of charge of not less than 95 percent. For an EV having a manual control for setting the level of regenerative braking, the manual control, at the beginning of the burnish procedure, is set to provide maximum regenerative braking throughout the burnish	**TE, C1** FMVSS specifies the battery charge conditions for EV in Burnish test
	N.A.	S6.3.11.3	At the beginning of each performance test in the test sequence (S7.2 through S7.17 of this standard), unless otherwise specified, an EV's propulsion batteries are at the state of charge recommended by the manufacturer, as stated in the vehicle operator's manual or on a label that is permanently attached to the vehicle, or, if the manufacturer has made no recommendation, at a state of charge of not less than 95 percent. No further charging of any propulsion battery occurs during any of the performance tests in the test sequence of this standard. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge brake warning lamp is illuminated, the vehicle is to be accelerated to brake test speed by auxiliary means. If a battery is replaced rather than recharged, the replacement battery shall be charged and measured for state of charge in accordance with these procedures.	**TE, C1** FMVSS specifies the battery charge conditions for EV

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Paragraph	Contents	Paragraph	Contents	
	N.A.	S6.3.12	***State of charge of batteries for electrically-actuated service brakes*** A vehicle equipped with electrically-actuated service brakes also performs the following test series. Conduct 10 stopping tests from a speed of 100 kph or the maximum vehicle speed, whichever is less. At least two of the 10 stopping distances must be less than or equal to 70 meters. The vehicle is loaded to GVWR and the transmission is in the neutral position when the service brake control is actuated and throughout the remainder of the test. Each battery providing power to the electrically-actuated service brakes, shall be in a depleted state of charge for conditions (a), (b), or (c) of this paragraph as appropriate. An auxiliary means may be used to accelerate an EV to test speed. (a) For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with automatic shutdown capability of the propulsion motor(s), the propulsion batteries are at not more than five percent above the EV actual automatic shutdown critical value. The critical value is determined by measuring the state-of-charge of each propulsion battery at the instant that automatic shut-down occurs (b) For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries and with no automatic shutdown capability of the propulsion motor(s), the propulsion batteries are at an average of not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated. (c) For a vehicle which has one or more auxiliary batteries that provides electrical energy to operate the electrically-actuated service brakes, each auxiliary battery is at not more than five percent above the actual state of charge at which the brake failure warning signal, required by S5.5.1(e) of this standard, is illuminated.	**TE** FMVSS specifies the battery charge conditions for EMB
		S6.5.4	***Vehicle position and attitude***	
	N.A.	S6.5.4.1	The vehicle is aligned in the center of the lane at the start of each brake application. Steering corrections are permitted during each stop.	**C1** FMVSS specifies permission of steering corrections
		S6.5.5	***Transmission selector control***	
	N.A.	S6.5.5.1	For tests in neutral, a stop or snub is made in accordance with the following procedures (a) Exceed the test speed by 6 to 12km/h (b) Close the throttle and coast in gear to approximately 3km/h above the test speed (c) Shift to neutral; and (d) When the test speed is reached, apply the brakes.	**C1** FMVSS specifies braking procedure in detail
	N.A.	S6.5.5.2	For test in gear, a stop or snub is made in accordance with the following procedures (a) With the transmission selector in the control position recommended by the manufacturer for driving on a level surface at the applicable test speed, exceed the test speed by 6 to 12km/h (b) Close the throttle and coast in gear; and (c) When the test speed is reached, apply the brakes. (d) To avoid engine stall, a manual transmission may be shifted to neutral (or the clutch disengaged) when the vehicle speed is below 30km/h	
	N.A.	S6.5.6	***Initial brake temperature (IBT)*** If the lower limit of the specified IBT for the first stop in a test sequence (other than a parking brake grade holding test) has not been reached, the brakes are heated to the IBT by making one or more brake applications from a speed of 50km/h, at a deceleration rate not greater than $3m/s^2$.	**C1** FMVSS specifies the method to adjust IBT

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	N.A.	S7	***Road test procedures and performance requirements*** Each vehicle shall meet all the applicable requirements of this section, when tested according to the conditions and procedures set forth below and in S6, in the sequence specified in Table 1: Road Test Sequence	**C1** FMVSS specifies the Road Test Sequence
		S7.1	***Burnish***	
	N.A.	S7.1.1	***General information*** Any pretest instrumentation checks are conducted as part of the burnish procedure, including any necessary rechecks after instrumentation repair, replacement or adjustment. Instrumentation check test conditions must be in accordance with the burnish test procedure specified in S7.1.2 and S7.1.3	**C1** FMVSS specifies the method of Burnish
	N.A.	S7.1.2	***Vehicle conditions*** (a) Vehicle load: GVWR only (b) Transmission position: In gear	
	N.A.	S7.1.3	***Test conditions and procedures*** The road test surface conditions specified in S6.2 do not apply to the burnish procedure. (a) IBT: 100 ℃ (212 degreeF). (b) Test speed: 80 km/h (49.7 mph). (c) Pedal force: Adjust as necessary to maintain specified constant deceleration rate. (d) Deceleration rate: Maintain a constant deceleration rate of 3.0 m/s 2 (9.8 fps 2). (e) Wheel lockup: No lockup of any wheel allowed for longer than 0.1 seconds at speeds greater than 15 km/h (9.3 mph). (f) Number of runs: 200 stops. (g) Interval between runs: The interval from the start of one service brake application to the start of the next is either the time necessary to reduce the IBT to 100 ℃ (212 degreeF) or less, or the distance of 2 km (1.24 miles), whichever occurs first.	

COMPARISON o **Differences between ECE R13-H and FMVSS135**

Definitions are not included.
see the Note at the end of this table.

Symbols
T;due to time to establish each regulation C1;prescribed in more detail for self-certification.
C2;difficult to adopt a paragraph written for self-certification.C3;due to certification difference
P;due to difference of philosophy.TE;technical discussion issue.O1;more detailed definition in either regulation.
O2:very similar. O3: should follow GRSG results for prescribed letters and colors

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5. 5.1. 5.1.1.	SPECIFICATIONS. General Braking equipment			
5.1.1.1./2.	Designed, constructed and fitted to meet this Regulation in normal vehicle use over long periods .	S5.6.	Brake system integrity. (Nearest equivalent) Each vehicle must meet the complete performance requirements of this standard without any mechanical failure in the system or fluid leakage becoming apparent.	O1
5.1.1.3	Brake linings shall not contain asbestos.	-	Not mandated	O2
5.1.1.4.	The effectiveness of the braking equipment shall not be adversely affected by magnetic or electrical fields. (This shall be demonstrated by compliance with Regulation No. 10 - 02.)	-	Not mandated but similar expectation exists	P
5.1.1.5.	It shall be possible to generate maximum braking forces under static conditions on a rolling road or roller brake tester.	-	Not required	C3
5.1.2.	**Functions of the braking equipment**			
5.1.2.1.	Service braking system To safely control and halt the vehicle, whatever its speed and load, under all driving conditions with graduable braking action from the driving seat, whilst both hands are on the steering control.	. S5.3. S5.3.1.	Not specifically defined but Service Brakes is a term used in 135. No equivalent mission statement Controls. The service brakes shall be activated by means of a foot control.	Almost O2 C3 and P Almost O2
5.1.2.2.	Secondary braking system	.	Not defined as such but assumed to be part of the service braking system.	
5.1.2.2	To provide similar graduable braking action from the service brake control, but of reduced intensity in the event of failure in the service braking system. It is assumed that not more than one failure in the service braking system can occur at a time.	S6.5. S6.5.1.	However, tests under these failure conditions are required. All service brake system performance requirements, including those partial system requirements of S7.7, S7.10 and S7.11, must be met solely by use of the service brake control.	C3 and P
5.1.2.3.	Parking Braking system. To allow the vehicle to be held stationary on an up or down gradient by action from the driving seat	S7.12.	No purpose statement on this. Tests of holding on up or down gradient	P
5.1.3.	Annex 8 requires documentation on the safety aspects of complex electronic vehicle control systems which are associated with the braking function.. This is the paragraph which calls for Annex 18 inclusion		No statement if and until new technology systems are considered	T, C2
5.2.	**Characteristics of braking systems**	S5.	Equipment requirements is a similar section but deals with different topics	
5.2.2.1.	Service, secondary and parking braking may use common components if: there are at least two independent controls easily reached from the driving position and returning braking to zero on release. The parking brake is to be mechanically locked when applied but able to be released manually	S5.3.1.	The service brakes shall be activated by means of a foot control.	**O1**
5.2.2.2.	The service brake control must be independent from the parking brake control.		The control of the parking brake shall be independent of the service brake control, and may be either a hand or foot control.	**O2**
5.2.2.3.	Linkage effectiveness in the transmission systems must not be liable to diminish in use;		No such statement though the same type of braking system is in use.	**O1**
5.2.2.4.	Dynamic operation of the parking brake or operation of the service braking system from the park brake control is required as an alternative.		Not yet incorporated	**P** Dynamic PKB TE

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5.2.2.5.	The service braking system and the parking braking system may use common transmission components, but secondary braking must be ensured in the event of a transmission failure.		No similar requirement	**T & P**
5.2.2.6.	Split system requirement A failure in the service braking system (other than the brakes) or malfunction, partial or total exhaustion of an energy reserve, must leave the remaining section of the system, able to generate secondary braking;		No statement of principle or intent but: Separate component or sub-system failures dealt with in the performance tests.	**O2**
5.2.2.7	In a power assisted braking system with a failure of that assistance, secondary braking must be ensured by the driver's muscular energy. (If other reserves of energy are able to be directed to assist the driver, this is permitted)	S7.11.	A similar requirement is in force and is tested as a failure case.	**O2**
5.2.2.8.	In a full power braking system, there must be 2 energy reserves with separate independent transmissions acting on the brakes and each so arranged as to be capable of alone achieving secondary braking without endangering the stability of the vehicle.	S7.11.	A similar requirement is in force and is tested as a failure case.	**C1**
		S7.11.4.	Performance requirements. The service brakes on a vehicle equipped with one or more brake power assist units or brake power units, with one such unit inoperative and depleted of all reserve capability, shall stop the vehicle at 2.44m/s^2	**O1**
	in addition, each energy reserve must be equipped with a low pressure warning.	S5.5.1.	Brake system warning indicator is mandated. S5.5. lists all the warning sources with S5.5.1.a (3) being the low pressure equivalent	**O1**
5.2.2.9.	In a full popwer system transmission, one energy reserve is sufficient if secondary braking can be achieved by muscular energy alone acting on the service brake control and the switch-over is failsafe. (5.2.5.)	S7.11.4.	No statement of principle but similar performance requirements are called for in the failure test section. Ie. No energy reserve and 2.44m/s/s must be achieved	**C1**
5.2.2.10.	Certain mechanical parts, are not be regarded as liable to breakage given certain constructional and maintenance requirements.	S5.6.	Brake system integrity statement is the nearest equivalent but is only an implied principle.	**O1**
5.2.3.	Hydraulic transmission failure shall give a driver RED warning signalled by a differential circuit pressure of 15.5 bar or less, or by low fluid level in the master cylinder reservoir..	S5.5.1.	Warning signalled from a gross loss of fluid or fluid pressure. A drop in fluid level in the brake master cylinder reservoir, or: on vehicles equipped with a split service brake system, a differential pressure of 1.5 MPa (218 psi) between circuits	O1 FMVSS permits flashing warning light.
	This warning must be visible even by daylight and be tested at start up.	S5.5.	Each vehicle shall have one or more visual brake system warning indicators sited in clear view of the driver. Additionally, a vehicle with a **non-split** service brake system shall have an audible warning signal.	**O1**
	Application of the parking brake must also be indicated to the driver.	S5.5.1.(c)	Application of the parking brake is to be warned.	**O2**
5.2.4.	There need only be one energy source in a power assistance or full power braking system but the means by which it is driven must be as safe as practicable.		No prescription	**P C2**
5.2.4.1.	After a failure in a part of the braking transmission, the feed to the part not affected must, by means of an automatic device, continue to be ensured so as to provide for secondary braking.	S7.10.	A back-up system is mentioned but not prescribed. However, in the failure test S7.10.4.either a half system or a back-up system, has to ensure equivalent braking performance of 2.44 m/s^2.	**O2**
5.2.4.2.	Storage devices located down-circuit of this device must be able, with a failed energy supply, to provide for 4 full-stroke applications of the service brake control and then on the 5th, generate secondary braking.	S7.10.4	In a non-split system, this performance is required for 10 stops after a warning is given and this is to be met from stored energy.	**P C2**
5.2.4.3.	In a hydraulic system where 5.2.4.1. cannot be met, it is acceptable that after a single transmission failure, secondary performance can be achieved after 8 full stroke applications. (ie increased energy storage capacity)		See above S7.10.4. Equivalent but 10 stops required.	**P C2**

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5.2.5.	Operation of these power systems must be failsafe and not rely on redundant and dormant parts.		No mention of this principle but back-up systems are referred to in S7.11.	C2 P Te TBDiscussed automatic device normally at rest prohibited in ECE
5.2.6.	The service braking system shall act on all the wheels of the vehicle and shall distribute its action appropriately among the axles.	S5.1. S7.2. S7.4.	Service brake system. Vehicle to have a service brake system acting on all wheels. Tested in a wheel lock-up sequence or Torque Wheel Method of adhesion utilisation assessment.	O2
5.2.7.	Vehicles with electric RBS of category B, may have friction braking phased back to allow RBS alone to be applied, provided that both the following conditions are met:		Not mentioned	Te (RBS)
5.2.7.1.	Variations in RBS torque are automatically compensated by phasing relationship changes and: Behaviour on low adhesion meets Ax 5 distribution or Ax 6 ABS requirements.		Not mentioned	TE (RBS)
5.2.7.2.	braking rate remains related to the driver 's braking demand, having regard to tyre/road adhesion, reverting to all wheel braking if necessary.		Not mentioned	TE (RBS)
5.2.8.	Service braking to be distributed equally across an axle and compensation or other functions which affect this are to be made known.		Not mentioned	TE (RBS)
5.2.8.1.	Warning required when **compensation** exceeds the following limits;		Not mentioned	
5.2.8.1.1.	a difference in transverse brake pressures on any axle of 25% of the higher value for vehicle decelerations > 2m/sec/sec and a fixed min. value below this deceleration		Not mentioned	Te
5.2.8.2.	Compensation above, is permitted only when the initial brake application is made at vehicle speeds >10 km/h.		Not mentioned	Te
5.2.9.	Malfunctions of the EBS transmission shall not apply the brakes contrary to the driver's or system's intentions.			
5.2.10.	The service, secondary and parking braking systems must act on braking surfaces connected to the wheels through components of adequate strength.		Not mentioned	
	Where friction and RBS sources provide braking on an axle, disconnection of RBS is permitted, providing that the friction braking remains permanently connected and able to provide the compensation referred to in paragraph 5.2.7.1.		Not mentioned	
	During short disconnection transients, incomplete compensation is accepted given at least a certain response and friction braking has to ensure prescribed service & secondary braking.		Not mentioned	
	Disconnection of parking braking surfaces is permitted only if controlled by the driver and not as a result of leakage.		Not mentioned	
5.2.11.	**Lining wear** must be capable of being taken up by automatic means and brakes must have a reserve of travel. Adjustment devices must allow normal running after heating and cooling tests.	S5.1.1.	Automatic adjustment for wear compensatiion is required.	O2
5.2.11.2	It must be possible to easily check the wear on service brake linings from outside or under the vehicle using normal vehicle tools possibly via inspection holes. The removal of front and / or rear wheels is permitted for this purpose.	S5.1.2.(b)	Visually checks of brake lining wear, from outside or under the vehicle, using normal vehicle are required. The removal of wheels is permitted for this purpose.	O2
	Alternatively, acoustic or optical devices warning the driver at his driving position when lining replacement is necessary are acceptable.	S5.1.2(a) S5.5.1(d)	Acoustic or optical devices warning the driver at the driving position when lining replacement is necessary, An electrical device providing an optical warning of lining wear-out is permitted and may use the brake failure indicator.	O2 O2

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	The yellow warning signal specified in paragraph 5.2.21.1.2. below, may be used as the optical warning signal.	S5.5.5(d).6	If a separate indicator is provided to indicate brake lining wear-out as specified in S5.5.1.(d), the words "Brake Wear" shall be used.	01
5.2.12	**Fluid Reservoir (hydraulic)** . Filling ports to be readily accessible and reservoir mouldings made so as to show fluid levels without opening. Low fluid level warning has been dealt with earlier.	S5.4.4	**Fluid reservoirs** to be so constructed that the level of fluid can be checked without opening. ie. equipped with a transparent reservoir and/or a brake fluid level indicator.	02
	Minimum reservoir capacity is defined as the fluid displacement resulting when all brake cylinders move from a new lining, fully retracted position to a fully worn, fully applied position.	S5.4.2	Minimum reservoir capacity is defined as the fluid displacement resulting when all brake cylinders move from a new lining, fully retracted position to a fully worn, fully applied position.	02
	If this capacity is not provided, the red warning signal must indicate any fall in the level of reserve fluid liable to cause a failure of the braking system.	S5.5.1(a)(1)	Fall of brake fluid level in the reservoir to less than the manufacturer defined safe level or down to a quarter full (whichever is greater) has to give a warning.	01
5.2.13	Hydraulic braking fluid to be identified by indelible standard symbol and marking which is easily read and near to the filling port.	S5.4.3	Comparable requirement but in more detail as regards letter size and colours	01
5.2.14.1	A vehicle with a full power braking system actuated from an energy reserve, which cannot achieve secondary braking without this stored energy, must provide a RED optical or acoustic warning signal when the stored energy falls to a value at which, without re-charging of the reservoir, it is **only just** possible to achieve a fully laden secondary braking performance on a 5th application after 4 full-stroke actuations. (with brakes adjusted as closely as possible).	S5.5.1(a)(3)	A drop in the supply pressure in a brake power unit to half of the normal system pressure must generate a brake system warning.	02
	This warning device must be permanently connected and when the engine is running under normal conditions of fault free repeated braking, the warning device must give no signal except during the time required for initially charging the energy reservoir(s).		No specification of 'no signal under normal braking operation'.	
5.2.14.2	Vehicles which require an stored energy and which cannot meet secondary performance with a half-system, must signal a falling energy level with both optical and acoustic warnings. The acoustic signal must not be present before the optical signal.	S.5.5	Vehicles which are manufactured without a split service braking system shall have an audible warning of a drop in the supply pressure to the brake power unit	02
5.2.14.3	This acoustic alarm can be suspended while the parking brake is applied or, the automatic transmission the selector is in the "Park" position.	S5.5.3	No similar allowance	
5.2.15	Where an auxiliary source of energy necessary for braking the reserve of energy must be able to maintain full braking for 1 stop should the engine stall or the energy source suddenly fail	S7.7	1 stop required after the engine is turned off when energy storage is charged to normal running level.	02
This should be deleted Not a car requirement	In addition, if the muscular effort applied by the driver to the parking braking system is reinforced by a servo device, the actuation of parking braking must be ensured in the event of a failure of the servo device.			
5.2.16	If hydraulic power is also supplied to auxiliary equipment, energy must be distributed so that in the event of a source fault, the auxiliary equipment cannot drain the braking reserves to the warning level set out in 5.2.14. above.		No similar requirement	

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5.2.17	A motor vehicle equipped to tow a trailer with electric (service) brakes, has to have the following:		No similar specification though similar trailers may be towed	T TE
5.2.17.1	An electrical power supplycapable of providing the 15A current for trailer electric braking system. With the engine idling and all normal electrical loads switched on, the voltage must not fall below the value of 9.6V. The electrical lines must be short circuit protected;			T TE
5.2.17.2	With a failure in the motor vehicle's service braking system, the circuit not affected by the failure is to be capable of partially or fully actuating the trailer brakes;			T TE
5.2.17.3	The trailer feed can be from the stop-lamp circuit only if the existing stop-lamp switch and circuit will take the extra load.			T TE
5.2.18	Additional rules for vehicles with **electric RBS**			
5.2.18.1	Vehicles with electric RBS of **category A;**			
5.2.18.1.1	the RBS shall only be activated by the accelerator control and/or the gear neutral position.			
5.2.18.2	Vehicles with RBS of **category B**;	S5.1.3(a)	**Regenerative braking system** . For an EV RBS is considered to be part of the service brake system if it is automatically activated by an application of the service brake control, if there is no means for the driver to disconnect it and it is activated in all transmission positions (including neutral).	Te
5.2.18.2.1	Only automatic disconnection of a source of braking is allowed and paragraph 5.2.10. rules apply.			
5.2.18.2.2	Only one service brake control device is allowed;			
5.2.18.2.3	the service braking system is not to be adversely affected by the disconnection of the motor(s) or by the gear ratio used; (interpretation ??)		Nothing said (perhaps quite rightly) on this rule	
5.2.18.2.4	If RBS torque is controlled by the service brake control, a failure in the input/RBS-output relationship which upsets the distribution of braking (Annex 5 or 6) the driver must be optically warned on application of the control at the latest		Not mentioned	
5.2.18.3	Application of the service braking control must not reduce the Category A RBS braking effect generated by the release of the accelerator control;		Not mentioned	
5.2.18.4	RBS must not be adversely affected by magnetic or electric fields;		Probably intended but not specifically stated.	P
5.2.18.5	In vehicles equipped with ABS, this must control the RBS.	S5.1.3(b)	For an EV that is equipped with both ABS and RBS that is part of the service brake system, the ABS must control the RBS.	O2
5.2.1.18.6	State-of Charge of traction batteries. Method derived from SAE J227A	S6.3.11.1.	Same assessment basis used	O2
5.2.19	**Electrical parking brake (EPB)** Special additional requirements for EPB transmission:		Not mentioned but in current or future use.	O1
5.2.19.1	No unintended actuation of EPB is allowed under transmission fault conditions;			

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5.2.19.2	A wiring break or fault in the control must not prevent partial operation of the EPB giving vehicle holding on an 8% gradient. Alternatively, automatic operation of the EPB whenever the vehicle becomes stationary is allowed provided that 8% holding is ensured and park brake remains applied even with IGN-OFF. The park brake must automatically release as the vehicle starts to move again. In-gear or in Automatic-Park, the engine may be used to achieve or assist in achieving the 8% performance. A failed park brake has to be able to be released using tools or an auxiliary device carried or fitted on the vehicle.			
5.2.19.2.1	A break in the control transmission wiring or a failure in the park brake control shall be signalled to the driver. by the yellow warning signal as soon as the break/failure occurs. In addition, such a failure external to the electronic control unit(s) and excluding the energy supply, shall be signalled by flashing the red warning signal as long as the **ignition** switch is ON including also a period of not less than 10 seconds thereafter given that the **control** is ON Where a separate red parking brake warning signal as in 5.2.21.2, this should be the one which lights and flashes.			T
5.2.19.3	Where auxiliary loads are fed from the park brake transmission electrical supply the park brake system must have, in addition to the vehicle electrical load under non-fault conditions, the power to operate.			T
5.2.19.4	With the ignition switched OFF it shall remain possible to apply the park brake but not to release it.			
5.2.20.	**EBS special additional service braking requirements:**		Not mentioned.	T
5.2.20.1	Even with the IGN OFF, service braking performance must be ensured when the park brake is released, given sufficient energy is available in the service brake energy transmission.		Not mentioned	T
5.2.20.2.	A single transient fault in the control transmission of <40ms should produce no distinguishable effect on service braking performance.		It is doubtful whether this clause should be included	T
5.2.20.3.	An electric control transmission failure (but not in the energy reserve), that affects the function and performance of the service braking system, shall be indicated to the driver by the red or yellow warning signals (5.2.21.1.1. and 5.2.21.1.2.) depending on the failure severity. RED when prescribed service braking performance can no longer be achieved. YELLOW for electrical continuity faults which shall be signalled to the driver upon occurrance. Only where prescribed service braking performance can still be fulfilled and 2 circuits remain in operation, can a Yellow warning be used instead of Red. Even when the RED warning is given, secondary braking must be achieveable.		Not mentioned	T

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5.2.20.4.	Starting from the nominal battery voltage, failure of the alternator requires the full control of the service braking system to be guaranteed after 20 consecutive full stroke actuations. On test, the braking control is to be fully applied for 20 seconds and released for 5 seconds on each actuation. It is accepted during the test, that sufficient energy is available in the energy transmission to ensure full actuation of the brakes.		Not mentioned	T
5.2.20.5.	When the battery voltage falls below the manufacturer's value at which the prescribed service braking performance can no longer be guaranteed and/or which precludes at least two independent service braking circuits from each achieving the prescribed secondary braking performance, the Red warning signal specified in paragraph 5.2.21.1.1. below, shall be activated. After the warning signal has been given, application of the service braking control must generate the secondary performance. It is assumed that sufficient energy is available in the energy transmission of the service brakes.		Not mentioned	T
5.2.20.6.	If other vehicle loads are supplied from the same battery as the electric control transmission, it shall be ensured that, with the engine running at a speed not greater than 80% of the maximum power speed, the supply of electricity is sufficient to achieve prescribed service braking, by: Provision of an energy supply which is able to prevent discharge of the battery when all the auxiliary equipment is functioning or: Switching off pre-selected parts of the auxiliary load at a voltage above the critical level referred to in paragraph 5.2.20.5.so that further discharge is prevented. Compliance with this requirement may be demonstrated by calculation or by a practical test. This paragraph does not apply to vehicles where service braking can be reached with a non-electrical back-up.		Not mentioned	T
5.2.20.7.	If auxiliary equipment uses the same battery as the electric control transmission, the following requirements shall be met when the electrical source fails:		Not mentioned	T
5.2.20.7.1.	Whilst the vehicle is in motion, the battery power shall be sufficient to provide for brake actuation		Not mentioned	T
5.2.20.7.2.	When the vehicle is stationary with the park brake applied, the battery shall be able to power the lights even when the brakes are applied.		Not mentioned	T
5.2.21.	**Brake failure and defect warning signals** . The general requirements for optical warning signals which indicate to the driver, certain specified failures in the braking equipment, are listed below:	S5.5.	**Brake system warning indicator** . Each vehicle shall have one or more visual brake system warning indicators, mounted in clear view of the driver, which meet the re-quirements of S5.5.1 - S5.5.5. (135 lists the failures but 13-H has them scattered in the text)	P, T, O3 FMVSS label, colour defined. ECE colour shows severity
	(Audible warning is required for power systems without back-up - see 5.2.14.2.)		A vehicle manufactured without a split service brake system shall be equipped also with an audible warning signal that sounds under conditions set out in S5.5.1(a).	P
5.2.21.1.	Vehicles shall provide optical brake warning signals, as follows;	S5.5.1.	**Activation** .- A warning shall be indicated when the IGN is ON and whenever any of conditions (a) through (g) occur:	

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5.2.21.1.1.	RED warning signal indicates failures which preclude achievement of the prescribed service braking performance and/or the functioning of at least one of two independent service braking circuits;		(a) A gross loss of fluid or fluid pressure as indicated by one of the following conditions (chosen at the option of the manufacturer):	
5.2.21.1.2.	YELLOW warning signal indicates an electrically detected brake system defect which is not indicated by the above red warning signal.		(1) A drop in the master cylinder reservoir brake fluid level (in any compartment) to less than the manufacturer's recommended safe level or down to a quarter of the fluid capacity of that reservoir compartment, whichever is greater.	P
5.2.21.2.	The warning signals shall be visible, even in daylight and can be checkedfor operation from the driveing seat. Failure of any warning component shall not upset the braking system performance.		(2) For vehicles equipped with a split service brake system, a differential pressure of 1.5 MPa (218 psi) between the intact and failed brake circuits (measured at a master cylinder or a slave cylinder outlet).	
			(3) A drop in the supply pressure in a brake power unit to one-half of the normal system pressure.	P
	The sources of failure warning are referred to as '**specified failures** ' and are contained in the text of Reg.13-H as opposed to being listed together as in FMVSS 135.		(b) Any electrical functional failure in an antilock or variable brake proportioning system. (c) Application of the parking brake. (d) Brake lining wear-out, if the manufacturer has elected to use an electrical device to provide an optical warning to meet the requirements of S5.1.2(a).(e) For a vehicle with electrically-actuated service brakes, failure of the source of electric power to those brakes, or diminution of state of charge of the batteries to less than a level specified by the manufacturer for the purpose of warning a driver of degraded brake performance.	
			(f) For a vehicle with electric transmission of the service brake control signal, failure of a brake control circuit.	T EBS
			(g) For an EV with a regenerative braking system that is part of the service brake system, failure of the RBS.	O3 (EV)
		S5.5.5.	Labeling. (a) Each visual indicator shall display words as per Standard No. 101 (49 CFR 571.101), which shall be legible to the driver under all day and night-time conditions. The words shall have letters of defined size (3.2mm min) against contrasting backgrounds	O3
			(b) Vehicles manufactured with a split service brake system may use a common brake warning indicator to indicate two or more of the functions described in S5.5.1(a) through S5.5.1(d). If a common indicator is used, it shall display the word "BRAKE."	O3
			(c) A vehicle manufactured without a split service brake system shall use a separate indicator to indicate the failure condition in S5.5.1(a). This indicator shall display the words "STOP-BRAKE FAILURE" in block capital letters not less than 6.4 mm (1⁄4 inch) in height.	P, O3 FMVSS permits vehicles with non-split service brakes
			(d) If separate indicators are used for one or more of the conditions described in S5.5.1(a) through S5.5.1(g), the indicators shall display the following wording:	
			(1) If a separate indicator is provided for the low brake fluid condition in S5.5.1(a)(1), the words "BRAKE FLUID" shall be used except for vehicles using hydraulic mineral oil.	O3
			(2) If a separate indicator is provided for the gross loss of pressure condition in S5.5.1(a)(2), the words "BRAKE PRESSURE" shall be used.	O3

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			(3) If a separate indicator is provided for the condition specified in S5.5.1(b), the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled with the words "ANTILOCK" or "ANTI-LOCK"or "ABS"; or "BRAKE PROPORTIONING," in accordance with Table 2 of Standard No. 101.	O3 ABS Proportioning RBS letter vs symbol
			(4) If a separate indicator is provided for application of the parking brake as specified for S5.5.1(c), the single word "PARK" or the words "PARKING BRAKE" may be used.	T, O3 Brake Wear letter vs symbol
			(5) If a separate indicator is used to show lining wear-out as in S5.5.1(d), the words "BRAKE WEAR" shall be used.	O3 labeling in 135
			(6) If a separate indicator is provided for RBS (S5.5.1(g)), the letters and background shall be of contrasting colors, one of which is yellow. This shall be labeled "RBS." and failure in RBS that is part of the service brake system may also be indicated by the yellow lamp that is used for "ABS" failure which then displays the symbol "ABS/RBS."	O3
			(7) If a separate indicator is provided for any other function, the display shall include the word "BRAKE" and the appropriate additional labeling.	O3
5.2.21.3.	Except where stated otherwise:			
5.2.21.3.1.	a specified failure or defect shall be signalled to the driver by the above mentioned warning signal(s) not later than on actuation of the relevant braking control;	S5.5.1.	Activation. An indicator shall be activated when the ignition (start) switch is in the "on" ("run") position and whenever any of conditions (a) through (g) occur:	O1, O2
5.2.21.3.2.	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.	S5.5.3.	Duration. Each indicator activated due to a condition specified in S5.5.1 shall remain activated as long as the condition exists, whenever the ignition ("start") switch is in the "on" ("run") position, whether or not the engine is running.	O2
5.2.21.3.3.	The warning signal shall be constant (not flashing).	S5.5.4.	Function. When a visual warning indicator is activated, it may be continuous or flashing, except that the visual warning indicator on a vehicle not equipped with a split service brake system shall be flashing. The audible warning required for a vehicle manufactured without a split service brake system may be continuous or intermittent.	P Requirement of flashing warining indicator for non-split service brake
5.2.21.4.	These warnings shall light up when the electrical equipment of the vehicle is energised. At standstill, the braking system must verify that no failure or defect is present before extinguishing the signals. Failures/defects not detected under static conditions, shall be stored upon detection and be displayed at start-up and whenever the ignition switch is ON, as long as the failure/defect persists.	S5.5.2.	Function check. (a) All indicators to be activated as a check function by either: (1) Automaticaly when the ignition switch is turned ON it is in a check position between ON and START (2) A single manual push button action by the driver or, with a parking brake ndicator, by applying the parking brake when the ignition is ON. (b) In the case of a vehicle that has an interlock device that prevents the engine from being started under one or more conditions, check functions meeting the requirements of S5.5.2(a) need not be operational under any condition in which the engine cannot be started. (c) The manufacturer shall explain the brake check function test procedure in the owner's manual.	C1 Permit a test switch. Requires explanation of test procedure in owner's manual.
5.2.21.5. ?	**Non-specified failures** (or defects) or other information concerning the brakes and/or running gear of the motor vehicle, may be indicated by the yellow signal specified in paragraph 5.2.21.1.2. above, provided that all the following conditions are fulfilled:		Not mentioned	T Of doubtful need
5.2.21.5.1.	the vehicle is stationary;			T

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5.2.21.5.2.	after the braking equipment is first energised and the signal has indicated that, following the procedures detailed in paragraph 5.2.21.4. above, no specified failures (or defects) have been identified;			T
5.2.21.5.3.	non-specified faults or other information shall be indicated only by the flashing of the warning signal. However, the warning signal shall be extinguished by the time when the vehicle first exceeds 10 km/h.			T

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7.	**MODIFICATION OF VEHICLE TYPE OR BRAKING SYSTEM AND EXTENSION OF APPROVAL.**		Not Applicable.	C3
7.1.	Every modification of the vehicle type or its braking system to be notified to the administrative department which approved it. That department may then either:			C3
7.1.1.	consider that the modifications unlikely to affect operation and the vehicle still meets the requirements; or		.	C3
7.1.2.	require a further report from the Technical Service.			C3
7.2.	Notice of the decision to be communicated to the Parties to the Agreement.			C3
7.3.	The authority issuing the extension of approval assigns a number to the communication form.			C3
8.	**CONFORMITY OF PRODUCTION** procedures shall follow rules set out in the Agreement, Appendix 2 (E/ECE/324 - E/ECE/TRANS/505/Rev.2) with the following requirements:			C3
8.1.	An approved vehicle shall be manufactured to conform to theType approved by meeting the requirements of Section 5. above.			C3
8.2.	The authority which has granted type approval may every 2 years, verify the conformity control methods applied in each production facility.			C3
9.	**PENALTIES FOR NON-CONFORMITY OF PRODUCTION.**		Not Applicable.	C3
9.1.	Approval withdrawal and notification therof.			C3
10.	**PRODUCTION DEFINITELY DISCONTINUED.** Notification of discontinuance.			C3
11.	**NAMES AND ADDRESSES OF THE TECHNICAL SERVICES**			C3
Annex2	**ARRANGEMENTS OF APPROVAL MARKS.**		Not Applicable.	C3
Annex3	BRAKING TESTS AND PERFORMANCE OF BRAKING SYSTEMS.		No separate Annexed section in 135 but **S7** covers very similar tests.	P
Ax 3 1.	**BRAKING TESTS.**			
Ax 3 1.1.	General	S6.	General test conditions.	
Ax 3 1.1.1.	Performance is based on stopping distancefrom preset speeds but deceleration achieved is a vital parameter.Mean fully developed deceleration is the term used. This is deceleration (averaged wrt distance over a set speed difference - vb to ve in a stop from vo to zero).	S6.5.3.1.	The braking performance of a vehicle is determined by measuring the stopping distance from a given initial speed.	P No MFDD is prescribed in MVSS.
Ax 3 1.1.2.	The stopping distance is that covered by the vehicle from the moment when the driver begins to activate the brake control until the moment when the vehicle stops; the initial speed shall be the speed at the moment when the driver begins to activate the control of the braking system; and shall not be less than 98% of the prescribed speed for the test in question.	S6.5.3.3.	In the stopping distance formulas given for each applicable test (such as $S = 0.10\ V+0.0060V^2$), S is the maximum stopping distance in meters, and V is the test speed in km/h and in the second term, the deceleration is indicated by the 0.0060 coefficient of v^2.	

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	MFDD is calculated according to the following formula: $MFDD\ (dm) = \frac{vb^2 - ve^2}{25.92(Se - Sb)}\ m/s^2$ where: vo = initial vehicle speed in km/h, vb = vehicle speed at 0.8 vo in km/h, ve = vehicle speed at 0.1 vo in km/h, Sb = distance travelled between vo and vb in metres, Se = distance travelled between vo and ve in metres. Speed and distance are determined from measurements having an accuracy of ± 1% at the test speed. dm may be determined by other methods but with ± 3% accuracy.			
Ax 3 1.2.2.	Tests are carried out from speeds defined for each test; when maximum vehicle design speed is lower than that prescribed for a test, the test shall be made from the vehicle's maximum speed.	S6.5. S6.5.2.	Procedural conditions. Test speeds. Vehicles incapable of attaining the normal test speed, are tested from a speed that is a multiple of 5 km/h (3.1 mph) ie. 4 to 8 km/h (2.5 to 5.0 mph) less than its maximum speed and its stopping distance < that given by the formula provided for the specific test requirement.	C1
Ax 3 1.2.4.	the road must have a surface affording good adhesion, unless specified otherwise in the relevant Annexes;	S6.2. S6.2.1.	Road test surface friction. peak friction coefficient (PFC) of 0.9 with (ASTM) E1136 tire, under ASTM Method E 1337–90 at 64.4 km/h.	C1 FMVSS Prescribes measurment procedure.
Ax 3 1.2.5.	the tests must be performed when there is no wind liable to affect the results;	S6.1 S6.1.2.	Ambient conditions. Wind speed. The wind speed is not greater than 5 m/s (11.2 mph).	FMVSS Prescribes the max. wind speed
Ax 3 1.2.6.	at the start of the tests, the tyres must be cold and at the pressure prescribed for the load actually carried by the wheels of the stationary vehicle;	S6.3. S6.3.8.	Vehicle conditions. Tires are inflated to the pressure recommended by the vehicle manufacturer for the GVWR of the vehicle.	P Similar requirement
Ax 3 1.2.7.	the prescribed performance must be obtained without wheel locking at speeds exceeding 15 km/h, without deviation of the vehicle, from a 3.5 m wide lane, without exceeding a yaw angle of 15 ° and without abnormal vibrations;	S6.2. S6.2.3. S6.3. S6.3.	Road test surface and gradient. Lane width: tests are conducted on a test road 3.5 m (11.5 ft) wide. Vehicle loading and detailed preparations for testing. Procedural conditions. Vehicle position and attitude, alignment, steering correction and deviation defined along with detailed instructions on reaching the test speed.	C1 Similar requirement Similar requirements
Ax 3 1.2.8.	Vehicles powered completely or partially by electric motor(s), permanently connected to the wheels must perform the tests with these motor(s) connected.		No similar statement. However a similar requirement would be likely.	O1 (EV)
Ax 3 1.2.9.	Vehicles with an electric RBS of category A, have test for behaviour on a low adhesion surface (see 5.2.2. of Annex 6) ;		No similar requirement	P (EV)
Ax 3 1.2.9.1.	Vehicles with RBS of category A: Transient disturbances such as gear changes or accelerator control release, must not affect vehicle behaviour on low adhesion surfaces.		No similar requirement	P, C2 (EV)
Ax 3 1.2.10.	Wheel locking is not allowed on low adhesion surfaces. However steering correction is permitted if rotation of the steering control is within 120 ° during the initial 2 seconds and not more than 240 ° in all.		No similar allowance	P, C2 (EV)
Ax 3 1.2.11.	A vehicle with electrically actuated service brakes powered from traction batteries (or an auxiliary battery) which receive(s) energy only from an independent external charging system. Batteries shall, during testing, be not more than 5% above that (low) state of charge at which the brake failure warning is given. Batteries may receive recharge during the tests, to keep them in the required range.	S6.3.12.	State of charge of batteries for electrically-actuated service brakes. For an EV equipped with electrically-actuated service brakes deriving power from the propulsion batteries. -Batteries are at not more than 5% above the automatic shut-down critical value or above the brake failure warning value . For a vehicle which operates the electrically-actuated service brakes from auxiliary batteries, each auxiliary battery is at not more than 5% above the state of charge at which brake failure is signalled.	TE (EV) FMVSS assumes automatic low voltage shut-down of propulsion motors.

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Ax 3 1.3.	**Behaviour of the vehicle during braking**			
1.3.2.	This behaviour of the vehicle on a low adhesion surface must meet the (stability) requirements of Annex 5/Annex 6.			P, C1, C2, C3, O2
(Annex5)	Distribution of braking among the axles of the vehicle.			P, C2, C3, O2
(Annex6)	Test requirements of vehicles fitted with ABS	S7.3. S7.8.	ABS performance. [Reserved] Antilock functional failure covered.	P C1
Ax 3 1.3.2.1.	In vehicles with RBS of Cat. B where braking for an axle is comprised of more than one source of braking torque, and any source can be varied, the vehicle shall satisfy the requirements of Annex 5/6 under all relationships permitted by its control strategy.		N.A.	P, T, C2 (EV)

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Ax 3 1.4.	**Type-0 test** (ordinary performance test with cold brakes)			
Ax 3 1.4.1.	General			
Ax 3 1.4.1.1.	The service brake temperature on the hottest axle of the vehicle is between 65 and 100 ° C prior to any brake application.	S4.	Initial brake temperature IBT defined: Set between 65 and 100°C at 0.32 km (0.2 miles) before any application.	O2
		S6.4.1.	Temperature measurement using embedded thermo-couples is explained.	O1
		S7.5. S7.6.	Cold and High Speed effectiveness - Test conditions and procedures. IBT: 65 ° C - 100 ° C. Test surface: high mu.	
Ax 3 1.4.1.2.	The test must be conducted in the following conditions:	S6.3.	Vehicle conditions.	
Ax 3 1.4.1.2.1.	Vehicle must be laden, the distribution of its mass among the axles being that stated by the manufacturer.	S6.3.1. S6.3.1.1/2.	loaded to its GVWR such that the weight on each axle is in proportion to its GAWR at LLVW, the axle weight is proportional to its share of the GVWR.	C1 FMVSS gives procedure for adjusting axle weight.
Ax 3 1.4.1.2.2.	every test must be repeated on the unladen vehicle but as well as the driver there may be a a test passenger		For the test at LLVW, the vehicle is loaded to its LLVW by adding weight in the front passenger seat area.	
1.4.1.2.4.		S7.5/6.	Cold and high speed effectiveness - Vehicle load: GVWR and LLVW.	
Ax 3 1.4.1.2.5.	the road must be level; unless otherwise specified.	S6.2. S6.2.2.	Gradient. Except for the parking hill test, the test surface has a 1% max. longitudinal gradient and a 2% max. transverse gradient.	C1
Ax 3 1.4.1.2.4.	The limits prescribed for minimum laden and unladen performance are set down below and the vehicle must satisfy both stopping distance and mfdd, but both may not be need to be measured.	S6.5.3.2.	The vehicle should be stopped in the shortest achievable distance and where multiple stops are required compliance with the requirements is accepted if at least one of the stops is made within the set distance.	Both general conditions of testing.
	Each test may comprise up to 6 stops (including any needed for familiarization).	S7.5/6.	Cold and High Speed effectiveness Test Number of runs: 6 stops.	
Ax 3 1.4.2.	Type-0 test in Neutral (Cold effectiveness test). Service braking from 100 km/h to achieve mfdd of 6.43m/s^2 with control force of 500N max.	S7.5.	Cold effectiveness - Vehicle conditions. load: GVWR and LLVW. in Neutral from 100km/h at force<500N with cold brakes No wheel lock in 6 stops on: High mu surface, PFC of 0.9.	P
		S7.5.3.	Performance requirement. (a) Stopping distance for 100 km/h test speed: <70m (230 ft). (b) SD at reduced speed: S< 0.10 V+0.0060 V^2 (6.43m/s/s)	
Ax 3 1.4.3.	Type-0 test with engine connected. Service braking from 80%vmax but not above 160km/h. The test is not needed if vmax does not exceed 125km/h	S7.6.	High speed effectiveness. This test is omitted if vmax does not exceed 125 km/h (77.7 mph).	O2
Ax 3 1.4.3.1.		S7.6.1.	Vehicle conditions. Vehicle load: GVWR and LLVW. 6 stops under saqme conditions as S7.5..	
		S7.6.2.	Test surface: High mu, PFC of 0.9.	
	Minimum performance shall be: mfdd = 5.76m/s^2 at max control force of 500N.	S7.6.3.	Performance requirement. Stopping distance: S< 0.10 V+0.0067 V^2 (5.76m/s/s)	O2
Ax 3 1.5	**Type-I test**			
1.5.1	Heating procedure	S7.13.	Heating Snubs.	
	No ststement but same intent.	S7.13.1	**General information on the purpose.** Use of snub stops on a 45s cycle to heat up the brakes for the following hot performance test.	C1
Ax 3 1.5.1.1	The service brakes must be heated by applying and releasing the brakes 15 times with the vehicle laden. Braking from v1 = 80% vmax (but not<120km/h) down to v2 = 1/2v1 on a 45 s cycle.	S7.13.2. (a)	**Vehicle conditions.** Vehicle load: GVWR only.	O2

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Ax 3 1.5.1.2	15 cycles of 45s duration - where a cycle is the time between the initiation of one brake application and the initiation of the next. If the vehicle has insufficient acceleration to meet the 45s cycle time, this may be increased but in all cases, a period of 10 seconds must be allowed in each cycle for stabilizing the speed v1	S7.13.3	**Test conditions and procedures.** 15 snubs from 80% of Vmax but not >120 km/h down to one-half the initial speed. Adjust pedal force so as to maintain the deceleration rate of 3.0m/s^2. Immediately after the 15th snub, accelerate to 100 km/h (62.1 mph) and start the hot performance test.	C1 No allowance made for slow-to-accelerate vehicles.
		S7.13.3	Establish a cold IBT before the first snub of 55 - 65 ° C IBT before subsequent snubs increases due to braking	O2
		S7.13.3.,(f)	Maintain a 45 second interval between the start of brake snubs.	O2
Ax 3 1.5.1.3	Pedal force adjusted to maintain on each stop, a mean deceleration of 3 m/s$^{2.}$	S7.13.3.,(d 1)	Maintain a constant deceleration rate of 3.0 m/s^2 (9.8 fps^2).	O2
Ax 3 1.5.1.3	2 preliminary tests may be carried out to determine the control force.	S7.13.3.,(d 2)	Attain the specified deceleration within one second and maintain it for the remainder of the snub.	no trial allowed
Ax 3 1.5.1.4	During brake applications,use the highest gear ratio (but not overdrive).	S7.13.2.,(b)	Transmission position: In gear. (not specified which but highest is a reasonable assumption.)	C1
Not mentioned.		S6.5.5.2.	Instruction on how to make the snub stops: marginal overspeed, over-run braking then brake at 3m/s^2 down to lower speed.	
Ax 3 1.5.1.5	To accelerate after braking: use the gears so as to attain the speed v1 in the shortest possible time.	S7.13.3.,(g)	Accelerate as rapidly as possible to the initial test speed immediately after each snub.	O2
Ax 3 1.5.1.6	For low powered vehicles unable to meet the cycle times, tests may be carried out by achieving the prescribed speed before the first snub and thereafter by using the maximum acceleration available to regain speed and then braking at the speed reached by the end of each 45 second cycle.	S6.3.11.3	Given the SoC at the beginning of each performance test in the test sequence as detailed just below, no further charging of propulsion batteries occurs during any of the performance tests. If the propulsion batteries are depleted during a test sequence such that the vehicle reaches automatic shut-down, will not accelerate, or the low SoC brake warning lamp is lit, the vehicle is to be **accelerated to brake test speed by auxiliary means** . If a battery is replaced rather than recharged, the replacement battery shall be charged and SoC measured.	ECE permits decreasing test speed in these cycles after the first snub. FMVSS requires the prescribed speed to be forced by using other means.
1Ax 3 .5.1.7	For RBS (Cat B) equipped vehicles, the SoC of the vehicle batteries at the start of the test, shall be such that the RBS braking contribution does not exceed the minimum guaranteed by the system design. This requirement is deemed to be satisfied if the batteries are at one of the SoC conditions listed: at the manufacturers recommended max SoC level, at not less than 95% of full charge if there is no such recommendation or at the max charge level of the automatic on-vehicle charge control (for hybrid vehicles).	S6.3.11.3	At the beginning of each performance test in the test sequence (S7.2.- S7.17.), an EV's propulsion batteries are at the SoC recommended by the manufacturer, or if there is no such recommendation, at a SoC of not less than 95%.	P,T condition of the vehicle batteries at the start of test
Ax 3 1.5.2	**Hot performance.**	S7.14	**Hot performance** .	
Ax 3 1.5.2.1.	This test is to be performed as soon as the Type I (heating) test is completed.	S7.14.1	The hot performance test is conducted immediately after completion of the 15th heating snub.	O2
Ax 3 1.5.2.1.	With the vehicle laden and the engine disconnected	S7.14.2(a)(b)	Vehicle load at GVWR only and in Neutral.	O2
	The hot performance of the service braking system must be measured in the same (laden)conditions using a mean control force no greater than the mean force actually used in the Type-0 test with the engine disconnected.	S7.14.3	IBT: is that achieved at completion of heating snubs. Speed: stop from 100 km/h at Pedal Force used in shortest GVWR cold effectiveness stop. No lock-up of any wheel..	O2
Ax 3 1.5.2.2	This hot performance must not be less than 75% of that prescribed, nor less than 60% of the figure recorded in the Type-0 test with the engine disconnected.	S7.14.4(a)	The first stopping distance must not be more than the calculated distance based on 60 % of the deceleration actually achieved on the shortest GVWR cold effectiveness stop. The following equations are to be used in calculating the performance requirement:	O2 virtually

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	R.13-H accepts mfdd deceleration figures.		$S=0.10V+\frac{0.0386V^2}{0.06(d_c)}$ $d_c=\frac{0.0386V^2}{S_c-0.10V}$ where, d_c = the deceleration achieved in the shortest cold stop at GVWR S_c = actual stopping distance on the same stop at GVWR and V = cold effectiveness test speed (km/h).	C1
Ax 3 1.5.2.5.	In the case of a vehicle which satisfies the 60% requirement but which cannot meet the 75% requirement, a further hot performance test may be made at a control force up to 500 N and should be undertaken immediately after the first..	S7.14.4(b)	In addition to the above, a second stop is made immediately after the first, with up to 500N force. Stopping distance for this must be 89 m from 100 km/h (for reduced test speed, $S < 0.10 V + 0.0079 V^{2)}$.ie. deceleration is 75% of the cold effectiveness requirement. The second stop may not be used to meet the 60% requirements of S7.14.4.(a) above.	O2
Ax 3 1.5.2.4	Vehicles with cat B RBS, having carried out the heating cycles must make the hot performance test from the maximum speed attainable, unless 100 km/h can be reached. For comparison, a later Type-0 test with cold brakes needs to be repeated from this same speed and with a similar RBS contribution, as was produced during the hot performance test. Following the recovery process and test, further reconditioning of the linings is permitted before the test is made to compare this second cold performance with that achieved in the hot test, against the criteria of 1.5.2.2. or 1.5.2.5. of this Annex."	S6.3.11.3.	At the beginning of each braking performance test in the full sequence, unless otherwise specified, an EV's propulsion batteries are at the state of charge recommended by the manufacturer or, not less than 95% if there is no such recommendation. No further charging of any propulsion battery occurs during any performance test If the propulsion batteries are depleted during a test such that the vehicle reaches automatic shut-down, will not accelerate, or the low state of charge warning lamp is illuminated, the vehicle is to be **accelerated to brake test speed by auxiliary means** . If a battery is replaced rather than recharged, the replacement shall be charged and measured for SoC as in these procedures.	P,TE ECE permits a reduced test speed in the hot test if that prescribed cannot be achieved. FMVSS requires the prescribed speed to be forced by using other means.
Ax 3 1.5.3	**Recovery procedure (Cooling Stops)** 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.	S7.15.1.	**Brake cooling stops - general information.** The Cooling stops are conducted immediately after completion of the hot performance test. Load: GVWR only, with IBT as existing after the hot performance test. 4 in-gear stops from 50 km/h with no wheel locking. Pedal force adjusted to maintain a deceleration of 3.0 m/s2	C1 (virtually O2)
			Procedure. Right after hot performance stops drive 1.5 km at 50km/h and make the first cooling stop. Accelerate at the maximum rate to 50 km/h and maintain that speed until beginning the second stop at a distance of 1.5 km from the beginning of the previous stop.Make the stop and repeat for a third and fourth stop after which accelerate at the maximum rate to 100km/h (62.1 mph). Maintain that speed until beginning the recovery performance stops at a distance of 1.5km (0.93mi) after the beginning of the fourth stop.	C1 more detail since speed changes
Ax 3 1.5.4	**Recovery performance** At the end of the cooling 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, using a mean force on the control, which is not more than that force used in the corresponding Type-0 test. 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.	S7.16.2.	Vehicle conditions. (a) Vehicle load: GVWR only. (b) Transmission position: In neutral.	C1
		S7.16.3.	**Recovery Test conditions and procedures.** IBT:That existing on completion of 2 cooling stops. 2 stops from 100 km/h at pedal force: no greater than the average force recorded during the shortest GVWR cold effectiveness stop. No wheel lockup Immediately after the 4th cooling stop, accelerate hard to 100 km/h (62.1 mph) and hold until beginning the 1st recovery performance stop 1.5 km after the beginning of the 4th stop. (If the vehicle cannot reach 100 km/h, it is tested at the speed used for the GVWR cold effectiveness test. Immediately after completion of this 1st recovery performance stop accelerate hard to 100 km/h again and make a 2nd recovery performance stop.	C1

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		S7.16.4.	**Recovery performance requirements.** S dist, for at least one of the two stops must be within the following limits: $\frac{0.0386V^2}{0.70d} \leqq S-0.10V \leqq \frac{0.0386V^2}{1.50d}$ where dc and V are defined in S7.14.4.(a).	
Ax 3 1.5.4.1	For vehicles with RBS of category B, the recovery test has to be made with no RBS component. After the further reconditioning of the linings, a second repeat Type-0 test is made from the same speed and with no RBS contribution as in the recovery test with the engine/motors disconnected, and comparison made between these test results. The recovery performance must not be less than 70%, nor more than 150% of the figure recorded in this final repeat Type-0 test."		Not mentioned	P,TE ECE requires a final test after fully reconditioning the linings and this is used as the cold Type 0 standard.
Ax 3 2	PERFORMANCE OF BRAKING SYSTEMS			
Ax3 2.1.2	A motor vehicle authorized to tow an unbraked trailer, must produce a combination Type-0 performance of not less than 5.4 m/s^2 in both the laden and unladen conditions. This figure may be verified by calculations referring to the maximum braking performance actually achieved by the motor vehicle alone (laden) during the Type-0 test with the engine disconnected. Using the following formula (no practical tests with a coupled unbraked trailer are required): $d_{M+R}=d_M \frac{P_M}{P_M+P_R}$ $dM+R=dM \cdot \frac{PM}{PM+PR}$ where: d_{M+R} = calculated **mfdd** of the motor vehicle when coupled to an unbraked trailer, in m/s^2 d_M = maximum **mfdd** of the motor vehicle alone achieved during the Type-0 test P_M = mass of the motor vehicle (laden) P_R = maximum mass of an unbraked trailer (declared by the motor vehicle manufacturer).		Not mentioned	P the max mass of an unbraked trailer is set by braking performance
Ax 3 2.2.	**Secondary braking performance** measured in a Type-0 test with the engine disconnected from 100 km/h at a force applied to the service brake control < 500 N. Tests are made laden and unladen.	S7.10.	**Hydraulic circuit failure. Single or split circuit - Half system failure.** Vehicle load: LLVW and GVWR. tested in Neutral	C1 C3
Ax 3 2.2.1.	Simulate a circuit failure in the service braking system Make Type 0 tests laden and unladen on high mu surface and a deceleration of $2.44m/s^2$ has to be achieved. Restore and repeat with the other circuit		Cold effectiveness test from 100 km/h at < 500N on high mu made with no wheel locking. Impose a single failure in the transmission and note the pressure or fluid level which causes a driver warning.	
Ax 3 2.2.4.	For vehicles with RBS, test also, without RBS braking and again with full RBS braking.		After warning a split system must give 4 stops each achieving $2.44m/s^2$ However, a non-split system must give 10 stops with this performance Repeat the entire sequence for each of the other subsystems in a	C1
Ax 3 1.11.2.	Energy source failure. Tests where secondary braking cannot be achieved by the driver's muscular energy alone.	S7.11.3	Brake power unit or brake power assist unit inoperative (System depleted). Tested in Neutral at GVWR only	C1

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Ax 3 1.2.1/2. Ax 3. 1.3.	Vehicles with stored energy: Disconnect the energy source with the reserve at cut-in pressure. Make 8 full service brake applications and 2.44m/s^2 must be achieved on the 9th. Vehicle which need power but without dual reserves, must meet this requirement after any single transmission failure with the energy source disabled or operating at engine idling speed. NOTE The failure is induced when the reserve is not in excess of the cut-in pressure.	S7.11.3. S7.11.3.(k)	Cold effectiveness test from 100 km/h at < 500N with no wheel locking on a high mu surface. Disconnect the power source and exhaust any reserve for 1 assist unit or 1 brake power unit. Use back-up means if such is provided (non-split system) Make 6 stops on which a deceleration of 2.44m/s^2 has to be achieved. Restore and repeat the test on the other subsystems. Restore the system to normal at completion of this test.	C1
	Not specifically mentioned but EBS rules apply and Secondary braking of 2.44m/s^2 is required. See 5.2.20.	S7.11.3(m)	For vehicles with electrically-actuated service brakes (brake power unit), this test is conducted with any single electrical failure in these service brakes with all other systems intact.	C1
Ax 3 2.2.4	For vehicles employing electric regenerative braking systems, the braking performance shall additionally be checked under the two following failure conditions:		N.A.	C2
Ax 3 2.2.4.1	For a total failure of the electric component of the service braking output.		N.A.	C2
Ax 3 2.2.4.2	In the case where the failure condition causes the electric component to deliver its maximum braking force.		N.A.	C2
Ax 4 2.3	**Parking braking system**	S7.12.	**Parking Brake**	
Ax 3 2.3.2	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.		Not mentioned although presumed applicable.	P
		S7.12.1.(c),	For vehicles with parking brake systems not utilizing the service friction elements, the friction elements of such a system are burnished prior to the parking brake test according to the published recommendations furnished to the purchaser by the manufacturer.	C1
		S7.12.1.(c),	If no recommendations are furnished, the vehicle's parking brake system is tested in an unburnished condition.	C1
		S7.12.1.(d)	Parking brake applications: 1 application and up to 2 reapplications, if necessary.	C1
		S7.12.2.(a)	Parking brake systems utilizing service brake friction materials shall be tested with the IBT < 100 ° C (212 ° F) and shall have no additional burnishing/heating prior to the start of the test.	C1
		S7.12.2.(a)	Parking brake systems utilizing non-service-brake friction materials shall be tested with these at ambient temperature at the start of the test. They shall have no additional burnishing or artificial heating prior to or during the test.	C1
		S7.12.2.(c)	Hand force measurement locations: The force required for actuation of a hand-operated brake system is measured at the center of the hand grip area or 40 mm (1.57 in) back from the end of the actuation lever (illustrated in Figure 3).	C1
Ax 3 2.3.5	A parking braking system needing several actuations to reach the prescribed performance is acceptable.	S7.12.2.(j)	In the case of a parking brake system that does not allow application of the specified force in a single application, a series of applications may be made to achieve the specified force.	C1
Ax 3 2.3.1.	The parking braking system must hold the laden vehicle stationary on a 20% up or down gradient.	S7.12.2.(f)	Drive the vehicle on to a 20% grade with the longitudinal axis of the vehicle in the direction of the slope of the grade.	C1
Ax 3 2.3.3/4.	Max. application force: 400 N (hand) and 500 N (foot)	S7.12.2.(g)	Stop the vehicle and hold it stationary by applying the service brake control and place the transmission in neutral.	C1

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		S7.12.2.(h)	With the service brake applied sufficiently to just keep the vehicle from rolling, apply the parking brake as specified in S7.12.2(i) or S7.12.2(j).	C1
		S7.12.2.(i)	With mechanically-applied parking brakes, make a single application of the parking brake control with a force not exceeding 400 N (hand) or 500 N (foot). With an electrically-activated parking brake, apply the parking brake by operating the parking brake control.	C1 but the same rules apply.
	Similar procedure is intended though no time duration is specified.	S7.12.2.(k)	Following the application of the parking brakes, release all force on the service brake control and, if the vehicle remains stationary check that the park brake warning is ON and that holding lasts for 5 min..	C1
	Not mentioned so no allowance is assumed.	S7.12.2.(l)	If the vehicle does not remain stationary, up to two more controlled applications may be made to attain position holding.	C1
	Similar procedure.	S7.12.2.(n)	If the vehicle holds position for the 5 min. in one direction, repeat the same test with the vehicle facing in the opposite direction on the same grade.	C1
Ax 3 2.3.6	Parking Brake Dynamic. To check compliance with the Parking brake dynamic requirement, a Type-0 laden test must be carried out, with the engine disconnected, at an initial test speed of 30 km/h. The mfdd upon application and the deceleration immediately before the vehicle stops, shall not be less than 1.5 m/s^2 The force on the braking control device shall not exceed 400 N (hand) or 500 N (foot)		Not mentioned.	P Dynamic PKB
Ax 3 3.	RESPONSE TIME - Boosted or full power system			
Ax 3 3.1.	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 timing requirements must be satisfied:		Not mentioned.	P Braking system with stored energy
Ax 3 3.1.1.	in an emergency application, the time elapsing between the moment when the brake 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 ;		Not mentioned.	P
Ax 3 3.1.2.	For vehicles fitted with hydraulic braking systems, the requirements of paragraph 3.1.1. are considered to be satisfied if, in an emergency brake application, the vehicle deceleration or the pressure at the least favourable brake cylinder, reaches a level corresponding to the prescribed performance within 0.6 seconds .		Not mentioned but similar timings expected.	P
Annex 4	PROVISIONS RELATING TO ENERGY SOURCES AND ENERGY ACCUMULATORS HYDRAULIC BRAKING SYSTEMS WITH STORED ENERGY 1. CAPACITY OF ENERGY ACCUMULATORS. No size defined but stored energy must provide 8 full brake actuations and meet secondary braking on the 9th. 2. CAPACITY OF HYDRAULIC FLUID ENERGY SOURCE. Based on a 'Pump-up time' (with engine at max power speed) to make up the consumption of 4 full brake applications. 3. CHARACTERISTICS OF WARNING DEVICES. Clearance between minimum and alarm pressures defined. With no energy supply, from the cut-in pressure 2 full brake applications must not result in a warning.	 S7.10. S7.11.3.	No specific mention but see Test S7.11. for similar performance Test requirements replace implied constructional standard 4 stops (or 10 stops for a non-split system) and then at 2.44m/s^2. 6 stops required for boost or power loss and then at 2.44m/s^2. Not specified or implied. Not specified or implied.	P P

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Annex 5	DISTRIBUTION OF BRAKING AMONG THE AXLES OF VEHICLES		WHEEL LOCKING ORDER	
Ax 5 1.	GENERAL. Vehicles which have no ABS must meet all the requirements of this Annex. If a special device is used, this must operate automatically. Braking rate range is 0.15 - 0.8	S7.2.1.	For vehicles with no ABS, wheel locking order has to be verified. Front axle wheels must lock before (or simultaneous with) rear axle wheels at braking rates 0.15 - 0.8. If this cannot be verified, the vehicle must be tested with Torque measuring wheels and the braking force distribution evaluated.	O2 An automatic device is needed to meet Annex 5 requirements.
Ax 5 3.1.(B)	For k values between 0.2 and 0.8, a defined stopping performance is required: z = or >[0.1 + 0.7(k - 0.2)] (diagram 1 of Annex 5)	S7.2.3(e)	Tests are made on 2 different surfaces which will, for each loading condition (LLVW and GVWR), result in a braking rate of between 0.15 and 0.8 when worst case conditions are sought.	
Ax 5 3.2.	In order to verify the requirements of paragraph 3.1. of this Annex, the manufacturer shall provide the adhesion utilization curves for the front and rear axles **calculated** from given formulae which take into account dynamic wheel loading. Curves of adhesion utilisation must be plotted for both the following load conditions:		Calculation is replaced by track testing on different surfaces. This means wheel locking tests which, to be successful, should clearly show fronts locking before rears. If not, more complex brake force measurement has to be undertaken with special instrumention: using Torque Wheels.	P
Ax 5 3.2.1.	unladen, in running order with the driver on board ;	S7.2.2.	LLVW	O2
Ax 5 3.2.2.	laden; and where variation of load distribution is possible, that whereby the front axle is the most heavily loaded shall be the one considered.	S7.2.2.	GVWR (complication of various load arrangements is not seen,perhaps correctly, as a requirement)	near O2
Ax 5 App 1 2./3.	**Wheel locking sequence test** is the same as S7.2. This test requires in-phase recording of: vehicle speed and deceleration, brake pedal force/line pressure and all wheel speeds. It is conducted using the procedure of S7.2.3. and requires the same results.	S7.2.3.	Test from 65 km/h, in Neutral with cold brakes and vary the pedal force to achieve a range of decelerations between 0.15 - 0.5m/s^2. Test also from 100 km/h where decelerations of 0.5 - 0.8m/s^2 are to be obtained. The tests are made on a variety of surfaces where skidding occurs at different braking rates in the range 0.15 - 0.8 and up to 1 kN pedalforce may be used to achieve this. Pedal force is applied with care so as to meet requirments below:	O2
		S7.2.3.(c)	Increase force linearly so that1st lock-up comes 0.5 - 1.5s after braking starts and release pedal as soon as 2nd axle locks or 0.1s after both wheel on 1st axle have locked or 1 kN has been reached. Wheel locking below 15 km/h does not count. For each surface, 3 runs meeting these requirements (out of 6 made) are used to determinr the result.	O2
Ax 5 App 1 4.	Exactly the same test results required.	S7.2.4.	To pass the test; Vehicle front wheels must lock before both rear wheels do so on the range of surfaces tested. If simultaneously (<0.1s) all wheels lock, this is treared as a pass but if on any surface there is no wheel locking, this is a fail condition. A fail requires the Adhesion Utilisation to be measured. (Torque wheels testing must be conducted). Vehicles with service brake RBS, must pass with: min. - max. RBS	O2
Ax 5 App 2	Torque Wheel test Method. The same procedure, data treatment and requirements apply.	S7.4.	Torque Wheel test Method Made under similar procedure to the previous test but wheel locking is not necessary as a high adhesion surface is used. Stops are: 5 from 100 km/h interspersed with 5 from 50 km/h. Record variables as previously but 2 circuit and individual brake pressures are important as the front/rear pressure relationship is needed. On a vehicle with variable brake proportioning, test laden and unladen but make 15 snubs from 50 km/h. Calculate, from the torque figures obtained, the braking rates and adhesion utilised at each axle and plot the distribution for laden and unladen. The adhesion curve for the rear axle must lie below the = 0.9k line. (k is the pfc) See fig 2 in S7.4.4.	O2

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Ax 5 4.	Braking Distribution Failure. Where the distribution device has failed, it must be possible to stop the vehicle (on a high adhesion surface) under Type 0 conditions-(Neutral from 100 km/h at < 500N) in S , 0.1v + 0.010v^2 ie mfdd of 3.86m/s^2.	S7.9.3.	Braking Distribution Failure. The service brakes on a vehicle equipped with one or more variable brake proportioning systems, in the event of any single functional failure in any such system, shall continue to operate and shall stop the vehicle as specified in S7.9.3(a) or S7.9.3(b). (a) Stopping distance for 100 km/h test speed: < 110 m (361 ft). (b) Stopping distance (reduced test speed) S < 0.10V + 0.010V^2.	O2 No MFDD is prescribed in MVSS but otherwise the same.
Ax 5 6.	CONFORMITY OF PRODUCTION			
Ax 5 6.1.	Procedures are the same as for Type Approval		N.A.	C3
Ax 5 6.2.	The requirements also as for Type-Approval, except that in the test of 5.2.(a)(ii), the rear axle curve must lie below the line z = 0.9 k for all braking rates between 0.15 and 0.8 as in Diag.1(instead of meeting the requirement in paragraph 3.1.(A Diag.2).		N.A.	C3
Annex6	TEST REQUIREMENTS FOR VEHICLES FITTED WITH ABS.	S7.3.	ABS performance. [Reserved]	
Ax 6 2.7.	Special ABS definitions: Sensor, Controller and Modulator - wheel conrtol and Full cycling.		No stated terms	P
Ax 6 3.	Types of Antil-Lock System - with 3 categories: Cat.1.gives full split-adhesion performance Cat.2. prevents wheels locking on split-mu. Cat.3. offers no split-mu performance.		No stated categorization.	P
Ax 6 4.1.	General Requirements. Any electrical failure detection and the yellow warning signal (5.2.21.1.2.) which is to be used.	S5.5.1.(3.b)	Requirement listed earlier.	O1
Ax 6 4.1.1.	Sensor anomalies to be detected, at the latest, when the vehicle speed exceeds 15 km/h.		No stated requirement	P
Ax 6 4.1.2.	Modulator cycle on switch-on. (Hydraulic self test?)	S5.2.	Start-up check a general requirement	O2
Ax 6 4.2.	A single electrical functional failure which affects only the ABS, to be indicated by the yellow warning signal and the subsequent service braking performance must not be less than 80% of prescribed Type-0 test level in Neutral. This means a stopping distance of 0.1v + 0.0075 v^2 (m) and mfdd of 5.15 m/s^2.	S7.8 S7.8.2. S7.8.3.	Antilock functional failure test. Vehicle loading: LLVW and GVWR in Neutral with cold brakes from 100 km/h at <500N. Make 6 stops on high mu and there should be no wheel lock. Simulate a functional failure by disconnecting power or other connection Note yellow lamp on and make a cold effectiveness stop in which SD from 100 km/h <85m or given from < 0.1v + 0.0075 v^2 (m) mfdd = (5.15 m/s2)	O2 No MFDD is prescribed in MVSS
Ax 6 4.3. Ax 6 4.4.	No adverse effect from electro-magnetic fields as set out in Reg.10 - 02. No manual control is allowed to switch off or change the ABS mode.		No stated requirement	P
Ax 6 5.	SPECIAL PROVISIONS.			
Ax 6 5.1.	Energy consumption Make a laden stop with ABS operating on low mu surface (0.3 or less) from 50 km/h for a time t in which no directly controlled wheel shall lock. Then stop the engine and fully apply the service brakes 4 times. On the 5th application mfdd of 2.44m/s^2 must be obtainable at < 500n pedal force..			TE

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Ax 6 5.1.2.	ABS tests in Neutral (engine idling) with a laden vehicle have to be made on a low mu surface with ABS operating for t = vmax/7 (ie. 15 - 23 s). This may be completed in up to 4 stages but no fresh energy can be supplied during this time. The remaining stored energy after the test runs and 4 full brake applications (minus those made when conducting the 2nd, 3rd and 4th stages as was required) must provide for secondary braking. (2.44m/s^2)		No specification for any ABS operational testing. However, this test on cars with electrically powered energy sources is probably not relevant.	TE
Ax 6 5.2.	Coefficient of Adhesion (k). This is measured on 2 surfaces (mu=0.3 and 0.8) using the vehicle (1.2.3. of Appx 2). The vehicle (with ABS disabled) is carefully braked on one axle only so that skidding just does not occur on those wheels between 40 and 20 km/h. The braking rate is processed in given formulae to find axle k. This is repested for the other axle and the two combined to produce a k for the surface.			TE
Ax6 5.2.3-6.	With ABS operating, adhesion utilisation is measured on both the surfaces by recording the braking rate achieved when braking both axles and calculated using given formulae. The efficiency needs to exceed 0.75 in both laden and unladen states to be acceptable. If skidding cannot be obtained when laden on high mu, this part of the test may be omitted.			TE
Ax 6 5.3.	Additional checks: In neutral, ABS operation is checked on sudden changes of adhesion to ensure control of wheel speeds is maintained. Vehicles with Cat.1 ABS have to meet control and stopping distance requirements on Split adhesion surfaces, whilst those of Cat.2 have only to retain wheel control.			TE
Annex6 Appendix 1	Vehicles with stored energy: Disconnect the energy source with the reserve at cut-in pressure. Make 8 full service brake applications and 2.44m/s^2 must be achieved on the 9th. Vehicles which need power but without dual reserves, must meet this requirement			TE
Annex6 Appendix 4	METHOD OF SELECTION OF THE LOW ADHESION SURFACE This requires mu/slip curve to be known and it must have a Kpeak/Klock ratio R of 1.0 -2.0 on the type of tyres being used.(2.5 is allowed as an exception) (mu levels should be around 0.3 and 0.8.)			TE
Annex7	INERTIA DYNAMOMETER TEST METHOD FOR BRAKE LININGS Alternative brake linings have to be checked by comparing their performance with those OE parts which are notified in the information document provided for the Type Approval process. Comparison can be made using an inertia dynamometer given certain rules and test equipment. 5 sets of linings of each type are needed which have been at least 80% bedded but not have exceeded 180 deg C. These are each subjected to 3 Type 0 Cold Performance tests and have to match, new to original, performance within +/-15%.	S7.1.1.	BURNISH A proceedure to condition new linings ready for testing, so that a realistic braking performance can be expected. This is done, on the vehicle in question, by making a series od 200 stops from 80 km/h on a high adhesion surface with a deceleration maintained at 3.0m/s^2. The stops sre spaced out by running in between at 80 km/h until the hottest brake has cooled down to <100 deg C. (A similar process is performed by the manufacturer before submitting a vehicle to Type Approval testing under Reg.13-H)	C3

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Annex8	SPECIAL REQUIREMENTS TO BE APPLIED TO THE SAFETY ASPECTS OF COMPLEX ELECTRONIC VEHICLE CONTROL SYSTEMS This defines the requirements for documentation explaining the fault strategy, safety concept and operating principles of Complex Electronic Control equipment. Reference is made to the supplier FMEA or similar and some means of verification and test is outlined.			P
	NOTE: DEFINITIONS ARE NOT INCLUDED IN THIS STARTING TABLE SINCE THEY ARE REQUIRED TO MEET THE NEEDS OF AN AGREED REGULATION TEXT AND ARE CURRENTLY NOT COMPATIBLE. A UNIFIED COMPOSITE TABLE OF DEFINITIONS WILL FINALISED TO COMPLEMENT THE CHOSEN WORDING OF THE GTR			