ECE No. 13.11/13H.00: Braking (ABS: Anti-lock Brake System) Technical requirement

The 61th Asia Expert meeting

5th - 6th Feb. 2020

JAPAN AUTOMOBILE STANDARDS INTERNATIONALIZATION CENTER

ECE No. 13.11/13H.00: Braking (ABS)

<Contents>

1. The main purpose of this regulation
2. Scope
3. Basic system structure of ABS
4. Summary of performance requirements
5. Detail of performance requirements
6. General requirements

Note:
Basically, the explanation is based on 13H.00

ECE No. 13.11/13H.00: Braking (ABS)

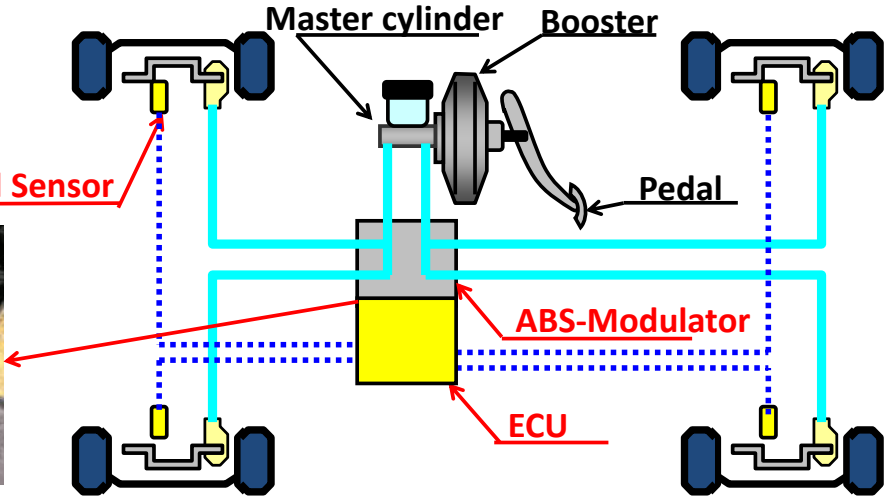
1. The main purpose of this regulation
   Definition (13 Annex13/13H Annex6):
   2.1
   An “anti-lock system” is a part of a service braking system which automatically controls the degree of slip, in the direction of rotation of the wheel(s), on one or more wheels of the vehicle during braking.

2. Scope
   ECE No. 13.11: M2, M3, N*
   (Mandatory: M2, M3, N2 and N3 with not more than 4 axles)
   ECE No. 13H.00: M1, N1*
   (if fitted)
   *N1 can use ECE No. 13 or 13H based on country’s decision.

ECE No. 13.11/13H.00: Braking (ABS)

3. Basic system structure of ABS

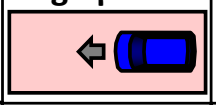
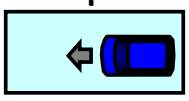
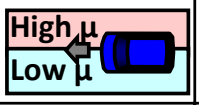
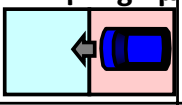
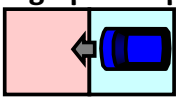
Following devises are added to the brake system without ABS.
Wheel Speed Sensor: Detect the wheel is rotating or not
ABS-Modulator: Control the braking force for each wheels
ECU: Control ABS-Modulator based on related parameters



ECE No. 13.11/13H.00: Braking (ABS)

4. Summary of performance requirements (1/2)

The table of requirements

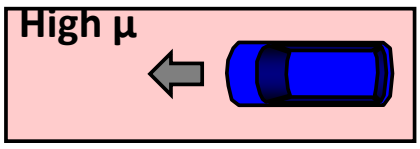
Road surface / Requirement	High μ 	Low μ 		Low μ High μ 	High μ Low μ 
Vehicle speed (km/h)	40, 120	40, 120	50	40, 120	50
$\varepsilon = \frac{z_{AL}}{k_M} \geqq 0.75$	○	○	○		
No wheel lock V ≥ 15 km/h	○	○	○	○	○
Yaw angle < 15 deg.	○	○	○	○	○
Not deviate 3.5m lane	○	○	○	○	○
Steering angle 120° /240°			○		
Not cross Lane boundary			○		
Rise Deceleration					○

ECE No. 13.11/13H.00: Braking (ABS)

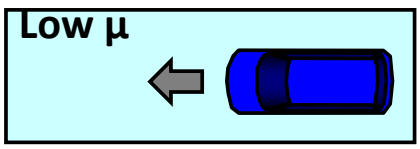
4. Summary of performance requirements (2/2)

Various road conditions

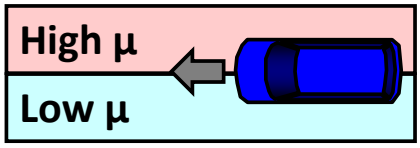
A : High μ road surface About 0.8



B : Low μ road surface 0.3 or less



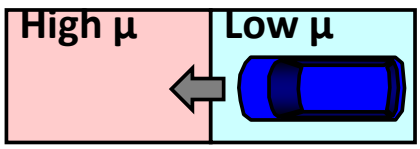
C : μ split (different μ on left / right)



$\text{High } \mu \geq 0.5$

$\frac{\text{High } \mu}{\text{Low } \mu} \geq 2$

D : μ jump (Low μ to High μ)



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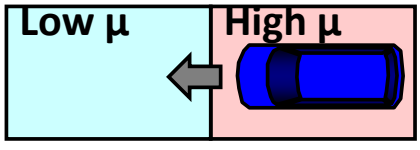
E : μ jump (High μ to Low μ)



ECE No. 13.11/13H.00: Braking (ABS)

5. Detail of performance requirements (1/5)
Efficiency of ABS (13H Annex6 5.2.1)

The efficiency of brake performance without ABS and with ABS is defined as below.

To prevent the slip, the weaken the braking force.
If to do so, the braking distance becomes be more longer…
But, the situation is not good. Then, the criteria is defined.

$$\varepsilon = \frac{Z_{AL}}{K_M} \geq 0.75$$

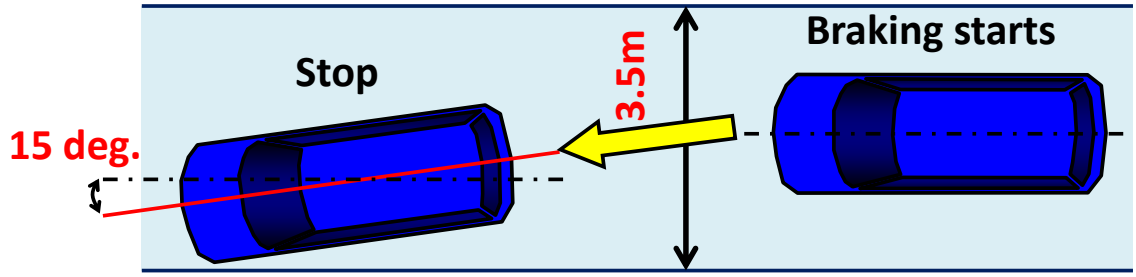
Z_{AL}: The brake performance with ABS
K_M: The brake performance without ABS

ECE No. 13.11/13H.00: Braking (ABS)

5. Detail of performance requirements (2/5)
Wheel lock, Yaw angle, Deviation (13H Annex6 5.3.6)

- ✓ The wheel lock is permitted when the vehicle speed is less than 15 km/h. (wheel lock is not occurred at exceed 15kn/h)
- ✓ The vehicle shall not exceed a yaw angle of 15 deg.
- ✓ The vehicle shall not deviate from a 3.5 m wide lane.

This requirement is applied for all ABS tests.



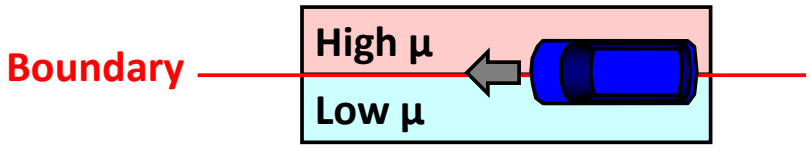
ECE No. 13.11/13H.00: Braking (ABS)

5. Detail of performance requirements (3/5)
<u>Steering angle, not cross lane boundary (13H Annex6 5.3.7)</u>

- ✓ Steering correction is permitted, if the angular rotation of the steering control is within 120 deg. during the initial 2 seconds, and not more than 240 deg.
- ✓ No part of the outer tyres shall cross this boundary.

This requirement is applied only for μ split road test.

μ split (different μ on left / right)



ECE No. 13.11/13H.00: Braking (ABS)

5. Detail of performance requirements (4/5)
<u>Steering angle, not cross lane boundary (13H Annex6 5.3.7)</u>

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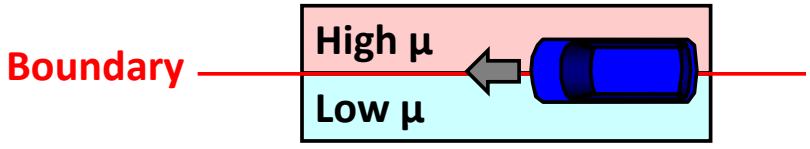


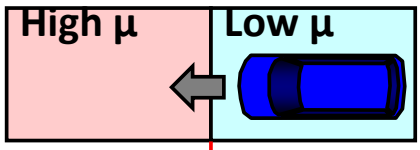
5. Detail of performance requirements (5/5)

Rise Deceleration (13H Annex6 5.3.3)

✓ The deceleration of the vehicle shall rise to the appropriate high value within a reasonable time.

This requirement is applied only for μ jump (Low μ to High μ) road test.

μ jump (Low μ to High μ)



The braking force can be increase, because the friction between tyre and road can be increase on High μ road .
So, The deceleration shall be risen.

The deceleration (braking force) is low, because to prevent slip on Low μ road.

ECE No. 13.11/13H.00: Braking (ABS)

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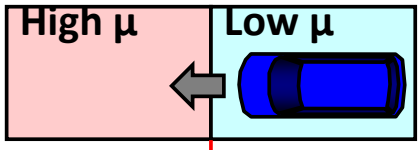

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ECE No. 13.11/13H.00: Braking (ABS)

6. General requirements (1/3)

13H Annex6 4.1

Any electrical failure or sensor anomaly that affects the system with respect to the functional and performance requirements 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 Regulation shall be used for this purpose.

(UN-R121)

ECE No. 13.11/13H.00: Braking (ABS)

6. General requirements (2/3)

13H Annex6 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 shall not be less than 80 per cent of the prescribed performance according to the Type-0 test with the engine disconnected.

ABS failure criteria	
Initial braking speed	100km/h
Stopping distance	$0.1V+0.075v^2$ (85m)
Mean deceleration	5.15 m/s^2 (80% of Type-0)
Pedal Force	65 to 500N

6. General requirements (3/3)

13H Annex6 4.3

The operation of the anti-lock system shall not be adversely affected by magnetic or electrical fields. (This shall be demonstrated by compliance with Regulation No. 10, 02 series of amendments).

13H Annex6 4.3

A manual device may not be provided to disconnect or change the control mode of the anti-lock system.

Thank you!