INTERNATIONAL UNION OF RAILWAYS

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BRAKES

HIGH POWER BRAKES

FOR PASSENGER TRAINS (1)

(1) Obligatory regulations are preceded by an asterisk : *

(Print of 1-1-80)

REVISIONS

Leaflet 546, 5th edition, 1-1-67

Amendment		Amendment	
No.	date	No.	date
1	1-1-71		
2	1-7-73		
3	1-1-80		
4	01-01-1981		
5	01-01-1983		

CHAPTER 1

GENERAL CONDITIONS TO BE FULFILLED IN THE USE OF HIGH POWER BRAKES FOR PASSENGER TRAINS

★ 1. The high power brake must be automatic.

★ 2. It must only require a single pipe for its operation.

★ 3. The working pressure must be 5 kg/cm^2.

The condition laid down in the 2nd sub-paragraph of § 7 of Leaflet 540 concerning the value of the maximum pressure in the brake cylinder is not applicable to high power brakes.

4. It is recommended that high power brakes be so designed that they prevent automatically any skidding. This recommendation is not valid for R brakes which are considered under Chapter II hereinafter.

★ 5. High-power brakes producing a brake-weight percentage exceeding the maximum allowed for R brakes, which are the subject of Chapter II hereinafter, must include a mechanism which enables their braking power to be reduced to a value between the limits stipulated in Leaflet 543, Chapter I, items 7 and 10.

6. The braking power of high power brakes shall be determined by the method indicated in Chapter IV of Leaflet 544-1. The brake-weight obtained shall be shown on the vehicle in accordance with the conditions laid down in Leaflet 545, Point 3.2.

★ 7. The high power brake must be so designed that it is possible to make certain, before departure, of the correct functioning of all the components of this apparatus which contribute to the obtainment of the high power, with the sole exception of the revolving parts, when such exist.

★ In addition, each vehicle must be fitted, inside, with a maximum pressure gauge on each brake cylinder.

★ 8. Before entry into service of any new coach fitted with high power brake equipment, the detailed description of this equipment must be communicated to the Railways concerned and a brief explanation giving the necessary information for checking the functioning of the brake must be placed in the coach.

CHAPTER II

SPECIAL CONDITIONS TO BE FULFILLED BY HIGH POWER R BRAKES FOR PASSENGER VEHICLES RUNNING AT A SPEED OF UP TO 160 km/h IN INTERNATIONAL TRAFFIC

★ 1. R brakes for coaches and baggage-vans of fast trains shall be high power brakes with one or two stages of brake-shoe pressure.

* Air brakes with a single stage of brake-shoe pressure shall be disc brakes or brakes with composite brake-shoe inserts.

* Air brakes with two stages of brake-shoe pressure shall be brakes with cast iron brake-shoes ; they have a high pressure at the beginning of braking, maintained constant so long as the speed is greater than a predetermined figure, and a reduced pressure which comes into operation as soon as the speed has fallen below this value and is maintained constant until the train has stopped. The two stages of brake-shoe pressure may be obtained either by having two conditions of pressure in the brake cylinder, or by using two brake cylinders, one of which is eliminated in order to give the lower stage of pressure.

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* 2- The braked weight of vehicles fitted with R brakes must be at least equal to 150 % of the vehicle tare and must not exceed 170 % of this tare. Vehicles built from 1-1-1984, loaded with the inclusive payload corresponding to UIC Leaflet 410, must have a braked weight percentage at least equal to 135 % of the total weight (tare + load).

* If the vehicle is fitted with a brake-pipe emptying accelerator, the brake-weight to be considered shall be that obtained when the accelerator is not in use.

3- Coaches and baggage-vans fitted with R brakes shall be accepted in conjunction, in the same train, with coaches and baggage-vans the braking power of which comes within the limits laid down in Leaflet 543.

*4- Coaches and baggage-vans fitted with R brakes shall be marked with the distinguishing sign ◇R◇ defined in Leaflet 545, Point 2.

* 5. When, on a separate vehicle, the brake is applied rapidly or normally, starting from the ordinary working pressure, the brake cylinder pressure must increase steadily until it reaches its maximum. In the case of emergency braking, the time required to fill the brake cylinder, measured from the moment when the air begins to enter the cylinder until the pressure therein reaches 95% of its maximum value, must be less than 5 seconds.

* 6. When, on a separate vehicle, the brake is completely and steadily released, after having been fully applied, the pressure in the brake cylinder must decrease continuously.

The time necessary to drain the brake cylinder, calculated, when the driver's brake valve is in the running position, from the moment when the air begins to escape from the brake cylinder until the pressure therein has reached 0.400 kg/cm^2, must be less than 20 seconds.

* 7. When, after having been fully applied, all the brakes on a train are released, without creating an overload of such a nature as to interfere with the subsequent operation of the brake, the time which elapses between the beginning of the release of the brake and the moment when the pressure in the brake cylinder of the last vehicle drops to 0,400 kg/cm^2, must not exceed 25 seconds in the case of a train of 15 vehicles, each having four axles.

* 8. As regards air brakes with two stages of brake-shoe pressure:

When the speed of the train is decreasing, the changeover from the higher to the lower brake-shoe pressure must be effective at 50 km/h approximately.

When the speed of the train is increasing, the changeover from the lower to the higher brake-shoe pressure must be effective at 70 km/h.

It is recommended that, when the question of adjusters is being considered, the possibility of adjusting the changeover speed between 70 and 85 km/h be provided for.

* **9.** The sensitiveness of the brake, on a separate vehicle, must be such that :

- it commences to operate not later than 6 seconds after the creation of a leak causing the pressure in the brake-pipe to be reduced by 0.600 kg/cm^2 in six seconds;

- it does not operate if a leak exists in the brake-pipe causing the pressure to be reduced by 0.300 kg/cm^2 in one minute.

* **10.** Under high-power braking conditions, the brake must be inexhaustible, i.e. it must always be possible, when applying it rapidly on a stationary train after the driver's handle has been turned in any direction to obtain, in the brake cylinders of the vehicles, a total pressure of at least 85% of the total pressure obtained on the same train after an emergency application carried out from normal working pressure. These operations shall not, however, involve the prolonged use of the neutral position of the handle, nor give rise, at any time, to a pressure in the brake cylinders of less than 0.300 kg/cm^2.

Under high-power braking conditions, the brake must enable the longest and steepest gradients occurring on the main railway lines to be negotiated with complete safety, and with as slight variations as possible from the prescribed speed.

* **11.** When the brake is applied in an emergency, starting from the normal working pressure, the measured braking transmission speed (1) must be at least 250 metres/second, irrespective of the composition of the train.

* **12.** The brake must always act in a reliable manner, without causing any danger to the passengers, the staff, the load, or the vehicles.

No harmful effects must occur when an emergency braking takes place after a normal strong braking, or when the brakes have to be cleared when running.

13. It is recommended that the brake equipment of vehicles *provided with a R high-power brake,* include a brake-pipe emptying accelerator complying with the conditions contained in Section V of Leaflet 541-1.

CHAPTER III

SPECIAL CONDITIONS TO BE FULFILLED BY HIGH POWER R BRAKES FOR PASSENGER VEHICLES RUNNING AT A SPEED BETWEEN 160 AND 200 km/h IN INTERNATIONAL TRAFFIC

* **1.** The brakes of passenger vehicles running at a maximum speed of 200 km/h in international traffic must fulfil the conditions laid down in Point 2 of Chapter II of this leaflet. When an emergency braking is made at 200 km/h, an average deceleration of 0.85 m/s^2 must be observed.

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(1) The transmission speed is obtained by dividing the length of the train brake-pipe, measured, irrespective of any connections, from the driver's brake valve to the stop cock at the rear of the train, by the time which elapses from the moment when the driver has placed his brake handle in the «on» position, until the air begins to enter the brake cylinder of the last vehicle (transmission period).

* **2.** The vehicles are to be fitted with disc brakes and composite brake-shoe inserts in accordance with the UIC provisions in force.

* **3.** When a composite (disc/shoe) brake is used, the additional shoe brake may be achieved - as a derogation from Chapter II - with one lower stage of brake-shoe pressure only. This additional shoe brake shall include a grey cast iron brake-shoe insert, in accordance with UIC Leaflet 541-1, on each wheel. The use of composite brake-shoe inserts is forbidden.

* **4.** (The conditions regarding the maximum braking power shall be specified subsequently).

* **5.** The use of the shoe brake as a single brake is not allowed.

* **6.** The vehicles are to be equipped with an electronic anti-skid device accepted in international traffic.

(1-1-81) ***7.** - Railways which deem that the existence of an electromagnetic brake is absolutely necessary on trains running at a speed exceeding 160 km/h are authorized to demand that foreign coaches incorporated in these trains be equipped with it. The electromagnetic brake must only come into play when an emergency braking operation is made.

8. The use of the dynamic brake is recommended on tractive vehicles.

The braking power percentage of tractive vehicles must approximately correspond to that of the load hauled.

APPLICATION

Obligatory provisions	With effect from
CHAPTER I	
6	1 January 1967
7. (2nd paragraph)	1 January 1959 (vehicles to be built or to be equipped)
CHAPTER II	
1. (2nd and 3rd paragraphs)	1 July 1973
(1-1-83) 2. (1st paragraph)	1 January 1984 (vehicles to be built)
6. to 9. (1st paragraph)	1 January 1961
10. to 13.	
9. (2nd paragraph)	1 January 1962
CHAPTER III (except Point 7)	1 January 1980 (Vehicles to be built)
7.	1 January 1981
Other provisions	1 January 1957.

All Railways in the Union.

RECORD REFERENCES

This leaflet, which was given the code number «546» in 1952, corresponds to previous Leaflet 197.

Headings under which the question has been dealt with :

- Examination of the international rules for eventual application with regard to the conditions to be fulfilled in the use of high-power brakes on passenger trains.
(5th Committee -R.S.- : Biarritz, June, 1948. - Board of Management : December, 1948. - General Assembly : December, 1948).

- Revision of UIC Leaflets.
(5th Committee -R.S.- : Lausanne, June 1952. - Board of Management : November, 1952).

- Examination of the special braking conditions to be imposed on carriages for their reciprocal use by Railways.
(5th Committee -R.S.- : Hamburg, July, 1954).

- Determination of the braking power of vehicles for speeds exceeding 120 km/h.

1. . . . . 2. Calculation of the stopping distance for the vehicles. 3. . . .

- Conditions to be observed concerning the maximum pressure in the brake cylinder.

- Amendment to Leaflet 546 «High-power brakes for passenger trains».
(5th Committee -R.S.- : Copenhagen, May-June, 1956).

- Supplements to Leaflet 546 «High-power brakes».
(5th Committee -R.S.- : Paris, June, 1957).

- Research in connection with a standard device for the inside of coaches equipped with high power brakes for checking the effective operating of such brakes during running, and use of the information given for this device by the Operating Department.
(4th-5th Committees -O.T.S.- : Budapest, June 1958).

- Additions to be made to Leaflet 546 «High-power brakes».

- Examination of the use of train pipe emptying accelerators.
(5th Committee -J.Q.- : Stuttgart, May, 1960).

- High power category R brakes. Speed at which the *high* power system should operate when the speed of the train increases.
(5th Committee -J.Q.- : Paris, May, 1961).

- Regulations concerning the determination of the brake-weight.

- Revision of the conditions of Leaflet 546 relating to the R brake.

- Introduction into Leaflet 544 of an explanatory text on the conditions of application of the various methods concerning the determination of the brake-weight.
(5th Committee -B- : Lisbon, May 1966).

- Anti-skid devices : preparation of regulations relative to their characteristics, use and the control of their operation.
(Rolling Stock and Motive Power Committee : Sofia, May 1979).

- High-power category R brakes. Amendment of the UIC Code Leaflet 546 with a view to the acceptance of brakes with a single stage of brake-shoe pressure (air brakes, disc brakes or brakes with composite brake-shoe inserts) as high-power category R brakes (brake weight percentage from 150 to 160).
(Sub-Committee for Braking : Paris, January 1973).

- *Question 5/T/27* - Study of the braking conditions for high-speed trains.
(Traction and Rolling Stock Committee : Paris, June 1979).

(1-1-81) - *Question 5/T/27* : Study of the braking conditions for high speed trains.
(Traction and Rolling Stock Committee : Oslo, June 1980).

1-1-83 *Question 5/T/FIC.* - Amendments to Leaflet 546 «Brakes - High power brakes for passenger trains».
(Traction and Rolling Stock Committee : Paris, October 1982).