

Rail System Forum

SET 07 – “Braking”

UIC – Question 5 - 110
Noise abatement -
Fitting composite brake blocks to wagons

Usage guidelines for composite (LL) brake blocks (10th edition)

Part 1

Fitting of wagons
with composite brake blocks with a low friction coefficient (LL)

Part 2

Brake operation, monitoring and maintenance

Applicable as of: 1 August 2013

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0. Preliminary comments

This document sets out the necessary provisions for the fitting of wagons (Part 1) and for their operation, monitoring and maintenance (Part 2), to allow them to be used with composite (LL) brake blocks approved against UIC Leaflet 541-4 and certified in accordance with UIC Leaflet 541-00.

Part 1 – Fitting of wagons with composite (LL) brake blocks

1.1 Brake design

The braking power shall be dimensioned as for cast iron brake blocks. If LL blocks are used on new wagons, the braking power shall be dimensioned in accordance with point 2.2 of UIC Leaflet 544-1 for cast-iron P10 blocks and preferably conform to the standard brake calculations for wagons as set out in Appendix O of that leaflet. Alternatively, the brake calculation can be performed in accordance with Appendix I of Leaflet 544-1.

The permissible technical scope for the deployment of LL brake blocks is defined as follows:

- Maximum velocity: ≤ 120 km/h,
- Maximum axle load: 22.5 t
- Brake block type: 2xBg or 2xBgu
- Area of use: all lines in the UIC area up to a maximum gradient of 40‰

There is no need to perform tests with LL blocks if the following conditions are fulfilled:

- Maximum velocity: ≤ 120 km/h
- Maximum axle load: 22.5 t
- Clamp-braked (double-sided brake application) wheels of nominal diameter 920 mm to 1000 mm
- Brake blocks of type Bg (divided) or Bgu (divided, sub-divided)
- Dynamic application force per brake block: 6 kN to 30 kN (Bg); 6 kN to 50 kN (Bgu).

If the aforementioned general conditions do not apply, the braking power shall be determined by testing.

If test results have been obtained on a reference vehicle, in order for these to be used the “reference vehicle” shall meet the following criteria:

- fitted with LL blocks,
- axle loads empty and loaded,
- maximum velocity for the foreseen service,
- dynamic brake block application forces in the various load conditions,
- type of brake equipment and number of wheelsets,
- nominal wheel diameter
- resistance to forward motion according to DT 308

¹ If calculated according to 4th edition of UIC Leaflet 544-1. Permitted real values (especially for older vehicles) may deviate.

1.2 Brake markings

Wagons fitted with composite (LL) brake blocks shall, as specified in EN 15877-1:2012, section 4.5.30.2.10, be marked with a letter LL (in a circle) immediately to the right of the marking indicating the brake type.

If a wagon is equipped with a parking brake, the maximum gradient on which the handbrake may be used with no risk of the wagon rolling away (calculated in accordance with UIC Leaflet 544-1; 5th edition, June 2013, section 8.2.3, "Holding brake vehicle immobilisation gradient") shall be marked on the wagon. The marking shall be in accordance with EN 15877-1:2012, section 4.5.25.

See Appendix 1.0 for a sample layout and a key to the brake markings.

1.3 Approved composite (LL) brake blocks - types and use

See Appendix M3 to UIC Leaflet 541-4, 4th edition, "fully certified products".

1.4 Brake components

- The existing components of the pneumatic and mechanical brake equipment are the same as those used with cast-iron brake blocks.
- For wagons with a nominal wheel diameter of between 920 mm and 1000 mm and a braked weight per wheelset of more than 15.25 t (14.5 t plus 5 %), the use of "inflected-curve" (kink) valves is mandatory. For wagons with a nominal wheel diameter smaller than 920 mm, this limit value shall be adapted in line with the energy input into the wheel rim.
- Brake block holders and brake blocks do not carry the "non-interchangeable" markings specified in UIC Leaflets 541-1 (brake block holders) and 541-4 (brake blocks).
- Where various block types are used on a vehicle, each wheelset must be fitted with blocks of the same type as a minimum.

1.5 Wheels / wheelsets to be used

Preferably, initial fitting with LL blocks should be combined with the installation of re-profiled wheels in order to comply with the inspection intervals as set out in section 2.2.3. For further conditions, see section 2.2.3.

For requirements regarding the flange thickness to be used with composite (LL) blocks, see section 2.2.3.

Monobloc wheels as per EN 13979-1 / UIC Leaflet 510-5

All monobloc wheels meeting the conditions of EN 13979-1 (and its application document UIC Leaflet 510-5) may be used.

Existing monobloc wheels

All existing types of monobloc wheels are approved, though **not** those made of the following materials: R2, BV2, R8, R9. Tyred wheels are **not** approved for use with composite (LL) blocks.

For use on vehicles in SS traffic, the use of wheels compliant with EN 13979-1 (and its application document UIC Leaflet 510-5) is **mandatory**.

Part 2 - Brake operation, monitoring and maintenance

2.1 Recommendations for brake operation

The train driver shall be informed as to the number of wagons braked with composite blocks in the train (see UIC Leaflet 472, International Train Journal and Braking Sheet).

Because composite brake blocks have a different friction behaviour to cast-iron blocks, especially at low speeds and under winter conditions, the following indication should be headed when operating the brake:

2.1.1 Operation of the handbrake/parking brake

In order to ensure sufficient restraining force when using the handbrake/parking brake, double the number of LL brake blocks are to be actuated compared with cast-iron blocks.

2.1.2 Using the brake at speeds of less than 50 km/h

When over half the wagons on a train are fitted with composite (LL) brake blocks, the effect of the brake during service brake applications from starting speeds of less than 50 km/h may be weaker than a train consist braked with cast-iron brake blocks alone. To compensate for this effect, either the brakes should be applied earlier or the pressure in the main brake pipe should be reduced to a greater degree.

2.1.3 Using the brakes in winter conditions

The following provisions are based on UIC Leaflet 421 and are of a recommendatory nature.

1. Definition of winter conditions from a braking perspective

- the temperature is below 0 °C and
- there is windblown snow on the tracks and/or
- the tracks are snow or ice-covered and/or
- there is a significant build-up of snow or ice on the wagons in service

2. Measures to guarantee brake performance

- Before moving stabled trains or parts of trains, a full brake application should be carried out (pressure drop in main brake pipe ~ 1.5 bar)
- During the brake test prior to leaving the departure station, the train should be checked to ensure that the blocks on either side are released
- During departure it should be checked that all the wheels on the train are rolling freely
- After leaving the departure station, the driver should carry out a service brake application before the full timetable speed has been attained, if possible without using the dynamic brake of the locomotive, to check whether braking performance is satisfactory.

If the train decelerates normally, the brake should immediately be released. If the brake is less effective than expected and if this can be ascribed to the prevailing winter conditions, the brake should be released and then fully applied again, so as to warm up the friction elements.

If brake performance is much lower than expected, an emergency brake application should be carried out until the train is immobilised, and during the rest of the journey the friction elements should be kept warm through periodic brake applications.

Accordingly a brake application should be carried out:

- every 10 to 15 minutes or
- every 20 to 30 km.

If in spite of all these measures the driver considers the deceleration insufficient, the train should only continue at a reduced speed. The driver should inform the regulator of the decision by radio.

The aforementioned brake applications should also be carried out before reaching:

- a terminus station,
- a long downward slope with a high gradient.

3. Other measures in winter operations

- The leak-tightness of the train is of particular importance in the brake tests.
- During maintenance and repair work all water should be thoroughly removed from the pneumatic parts of the train.
- In case of a significant build-up of snow or ice on the wagons in service, either the equivalent conicity value or the alternative parameter of flange height (both defined in section 2.2.3) should be checked during maintenance and repair work.

2.2 Monitoring measures

2.2.1 Monitoring of brake blocks

Pursuant to the GCU (General Contract for the Use of Wagons; Appendix 10, Point 3.8; ex-RIV 2000, Section 28.14) the blocks shall be exchanged if:

- the brake block is split through radially from the friction surface to the plate edge (except at the designated breakage point),
- the brake block shows visible crumbling of the friction material over more than ¼ of the block length,
- there are metallic inclusions,
- the block thickness is less than 10 mm.

Further indications on the assessment of brake blocks are given in the Composite Brake Blocks Damage Catalogue.

Maintenance of vehicles fitted with composite (LL) brake blocks shall be performed in the same way as for those fitted with cast-iron blocks.

When fitting block trains, it shall still be necessary to ensure that the maximum number of LL brake blocks not bedded-in in the train does not exceed 1/4 of the total number.

2.2.2 Monitoring of wheels

The following provisions are to be observed for wheels in accordance with UIC Leaflet 510-2:

In-service monitoring of wheels shall take place in accordance with the provisions of the GCU. All wheelsets of the wagons fitted with composite (LL) brake blocks shall be subject to a special examination on each visit to the workshop.

Monobloc wheels shall be inspected visually each time they visit the workshops (wheel tread in particular). Their condition and treatment shall be assessed against the criteria of the GCU (ex-RIV) and/or UIC Leaflet 510-2. During the inspection, particular attention should be paid to any sign of thermal overloading (e.g. clear, cleanly delimited paint burn under the wheel rim, blue-coloured wheel rims, material deposits), heavy or irregular wear, wheel tread damage and heat cracks.

Further indications on the assessment of wheels are given in the Composite Brake Blocks Damage Catalogue.

2.2.3 Monitoring of wheel profiles (running characteristics)

Based on the results of UIC B 126 / RP 43, the following recommendations are given for the composite (LL) brake block system. In the light of specific experience and where justified by a corresponding risk assessment, the ECM² may adapt the requirements.

2.2.3.1 General requirements (mandatory):

1. The equivalent conicity (a relevant parameter for the wheel/rail contact conditions) shall not exceed the value of 0.40³.
2. The wheel profiles shall be monitored at regular intervals.

2.2.3.2 One way to ensure the fulfilment of the requirements of section 2.2.3.1 is to apply the following measures:

1. A reduced nominal flange thickness of less than or equal to 30.5 mm (wheel profile as per EN 13715 - S1002) shall be used.
2. If using wheels with low flange thickness (see point 1), as an alternative to determining the equivalent conicity, a reduced in-service flange height limit value of 32 mm and an inspection flange height limit value of 31 mm may be used.
3. The first inspection following reprofiling shall take place after 100,000 km and thereafter every 50,000 km.
4. If the LL blocks are retro-fitted to non-reprofiled wheels, the first inspection shall be conducted directly after retrofitting. The equivalent conicity value or the alternative parameter of flange height shall comply with the requirements mentioned above (points 1 to 3). The next inspection shall take place after 50,000 km and thereafter every 50,000 km.

If higher nominal flange thicknesses or different wheel profiles are used, shorter inspection intervals need to be applied depending on the ECM risk assessment.

² Entity in Charge of Maintenance as set out in Directive 2008/110/EC of 16 December 2008

³ Calculated at an amplitude of $y = 3\text{mm}$ and applying the theoretical rail profile 60E1 (EN 13674-1) with a standard gauge of 1435 mm and a rail inclination of 1:40.

2.2.3.3 If nominal flange thicknesses of less than or equal to 30.5 mm (wheel profile as per EN 13715 - S1002) are used, the two options hereafter offer a way to adapt the general requirements, under the responsibility of the ECM⁴:

1. To be able to run wagons without monitoring of the wheel profile defined in section 2.2.3.1, their maximum operational speed of the wagon type shall be limited to 100 km/h. This is only applicable for wagons with running gear capable of a maximum operational speed of 120 km/h.

or

2. If the wagons' wheel profiles are to be monitored less rigorously, the wagons' running behaviour shall be verified against EN 14363 / UIC Leaflet 518, using wheelsets with an equivalent conicity higher than 0.40⁵. This verification shall demonstrate the wagons' compliance with the safety provisions of the standard/leaflet.

Monitoring of wheel profile following operational irregularities:

- Following locked brake incidents in service, either the equivalent conicity value or the alternative parameter of flange height shall be verified.

2.2.4 Monitoring of other components of the running gear

Based on the results of report UIC B 126 / RP 43 in certain application a higher wear and damage due to effects of fatigue on running gear components (e.g. springs, bogie frame or bolts) is possible.

It is recommended that the ECM take this into account when checking the effectiveness of their maintenance plan.

⁴ Entity in Charge of Maintenance as set out in Directive 2008/110/EC of 16 December 2008

⁵ Calculated at an amplitude of $y = 3\text{ mm}$ and applying the theoretical rail profile 60E1 (EN 13674-1) with a standard gauge of 1435 mm and a rail inclination of 1:40.

Sample layout and key to brake markings for composite (LL) brake blocks

Indication of the type of air brake
as per EN 15877

Marking for brakes with composite blocks (LL) as per EN
15877:2012, section 4.5.30.2.10

KE – GP – A
MAX: 58 t

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Indication of the braked weight of the air brake
as per EN 15877

Example of additional marking for manually-operated
handbrake.
For details, see EN 15877-1, section 4.5.25

