BS EN 15806:2010

BSI Standards Publication

Railway applications — Braking — Static brake testing

National foreword

This British Standard is the UK implementation of EN 15806:2010.

The UK participation in its preparation was entrusted to Technical Committee RAE/4, Railway Applications - Braking.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 57803 8

ICS 45.040; 45.060.01

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2010.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15806

October 2010

ICS 45.040; 45.060.01

English Version

Railway applications - Braking - Static brake testing

Applications ferroviaires - Freinage - Essai statique de freinage

Bahnanwendungen - Bremse - Statische Bremsprüfung

This European Standard was approved by CEN on 21 August 2010.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 15806:2010: E

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Foreword

This document (EN 15806:2010) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.

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For relationship with the EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

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Introduction

The objective of this European Standard is to provide a list of static test requirements which are at least to enable compliance with assessment of conformity after manufacturing.

This European Standard covers the static brake type and routine testing of brake systems used in railway vehicles. Only routine tested components may be used.

1 Scope

This European Standard specifies generic static tests requirements for the braking systems for all types of railways vehicles. Hereinafter all references to tests are to be read as “static” tests.

The methods of test and acceptance criteria are described in the appropriate standards (as example, for High speed trains, FprEN 15734-1 and FprEN 15734-2 apply).

Static tests conducted in normal service before the departure of the train are not considered in this standard.

This European Standard is applicable to brake systems on:

— all new vehicle designs of vehicles;

— all new constructions of existing vehicle types;

— all major overhauls of the above-mentioned vehicles if they involve redesigning or extensive alteration to the brake system of the vehicle concerned.

This European Standard does not apply to special transport systems (suspended monorail, rack and pinion lines, etc.), nor to investigative and supplementary tests.

Annex A presents the components and sub-systems to be incorporated in the brake system considered.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14478:2005, *Railway applications — Braking — Generic vocabulary*

EN 15595, *Railway applications — Braking — Wheel slide protection*

EN 15663, *Railway applications — Definition of vehicle reference masses*

EN 50125-1 *Railway applications — Environmental conditions for equipment — Part 1: Equipment on board rolling stock*

ISO 8573-1, *Compressed air — Part 1: Contaminants and purity classes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14478:2005 and the following apply.

3.1
brake test
test which aims to prove that a brake system complies with the requirements in terms of function and performance

NOTE The brake tests may comprise*:*

- type test;

- routine tests.

3.2
static tests
tests that are carried out whilst the vehicles and/or train are stationary and that may be part of the tests for the acceptance of a rail vehicle into service

NOTE Vehicle movements could occur at certain times during the testing (for example, during parking brake tests axle speed sensors tests).

3.3
train
single vehicle or a number of coupled vehicles operating on a guided ground transport system

3.4
type test
test of single devices, brake control circuits and complete brake systems on a complete vehicle or a train, to verify that the function and performance complies with the requirements specified for the type of vehicle or train concerned

3.5
routine test
test of the brake system to which each and every vehicle or train is subjected, after manufacture, in order to verify that it complies with the relevant criteria for the type of vehicle or train concerned

3.6
interface specification
specification describing the functional and component requirements to assure that the different brake sub-systems are able to operate together in the whole brake system (e.g. signal structure, pressure values, timing values)

3.7
stakeholders
bodies involved with the train design, train procurement, train maintenance, trains testing, etc. (e.g. notified body, train manufacturer, brake supplier, train operator, etc)

3.8
brake system specification
all points which shall be described in a brake system specification and containing at least the following requirements:

a) List of relevant documents:

   1) European directives

   2) European standards

b) Brake system requirements:

   1) Application and release timings

   2) Brake performance

   3) Load criteria

   4) Operational requirements

   5) Brake system failure consequences

   6) Brake control properties

   7) Train signalling / communication

8) Monitoring facilities

9) Adhesion criteria

10) Testing procedure

11) Isolating facilities

4 Symbols and abbreviations

WSP Wheel Slide Protection

G Good

P Passenger

R Rapid (High performance)

R+Mg Rapid + magnetic track brake

5 Test requirements

5.1 General

5.1.1 General test requirements

Prior to carrying out the requirements of the following brake system tests the vehicle/train shall have successfully completed the testing of all vehicle systems which interface with the brake system e.g. vehicle control systems, WSP systems, etc. and all wiring tests.

With a pre-serial unit or first vehicle/train of a serial production, type tests shall demonstrate that the brake system complies with the requirements. After successful passing of the type tests, routine tests shall confirm the technical stability of the production process of the system and its subsystems on subsequent trains following manufacture or modification as applicable. For this purpose, the final design of the system and its subsystems defined during the type test shall be considered. Brake testing shall also be undertaken if the brake system, and/or any other part of the train (e.g. train mass and/or load carried) has been changed from the final approved design referring to type test. (e.g. change of pad quality, shape). For example, this may be achieved by adjusting the settings of the existing brake equipment or installing new equipment, etc.

The content of this type testing, due to a brake design change, shall be agreed according to the modifications implemented.

Before carrying out these tests, the following conditions shall be assured:

— The train brake system has been assembled according to the manufacturer's design specifications;

— All system integration tests that could be carried out in advance of physical fitment of the brake system components to the vehicle/train to confirm their satisfactory interaction have been successfully carried out;

— All necessary component type / routine tests shall have been successfully completed. A non exhaustive list of brake components is given in Annex A.

— Tests associated with energy production (see ISO 8573-1) are supposed to be performed before beginning the static test on the train.

If more than one brake equipment type is used, the tests shall be conducted on each of these separately and in the used combinations to determine the functionality and response time of each single and combined equipment.

Where interactions between components and or subsystems has not been reliably verified by carrying out bench testing, these interactions shall be verified by testing after they have been integrated on the vehicle concerned.

5.1.2 Type test

Where type tests are deemed necessary they shall be performed on a vehicle or train considered representative of the remainder of the fleet or build of vehicles or trains that use the same type designation. These tests shall take place prior to any of that fleet or build of vehicles entering service and they form the basis of an acceptance of the brake system design.

The principal objectives of these type tests are to verify that the train's braking system and equipment complies with the requirements of brake system specifications and to establish the values of all the relevant parameters as a reference for assessing the dynamic performance.

If a multiple unit operation is required in the brake system specification, a static test shall be performed with a single unit and the longest multiple unit composition.

Where interactions between components and or subsystems has not been reliably verified by carrying out bench testing, these interactions shall be verified by testing after they have been integrated on the vehicle concerned.

5.1.3 Routine tests

Routine tests are to be carried out on every vehicle to verify conformance with the type-tested vehicle/train.

The principal objective of the routine tests is to verify that each train's braking equipment is consistent with that of the type tested train. All routine tests shall be completed successfully prior to the introduction of that unit or train into service.

5.2 General environmental conditions

The brake system and braking equipment shall be tested within the ranges of conditions as specified in EN 50125-1.

5.3 Table of tests

Table 1 lists the static tests that shall be carried out for all brake systems unless the nature of the brake system concerned is such that certain tests are not applicable (e.g. electrical tests for systems that do not use electricity as a control or power medium).

The Table 1 identifies the individual tests as stated in 5.4 and whether these tests should be conducted as part of type or routine tests conducted on an individual vehicle or train as applicable. The actual test sequence is at the discretion of the relevant test engineer.

NOTE The applicability of the tests should be agreed between the stakeholders involved.

These tests describe the minimum requirements for a static test.

Braking energy supply sub-systems are those systems used to store and distribute the energy subsequently converted into a force for retarding the train. These sub-systems include main compressors, auxiliary compressors, hydraulic pumps, accumulators, reservoirs, battery charging, auxiliary generators, etc. They are only considered insofar as the interaction they have with the brake system (e.g. the quantity of energy required from these sub-systems as a function of time). Braking energy supply may also be used for communicating the braking application and release commands.

The first three columns on the left in Table 1 describe the tests in terms of functions and what should be checked, and not the order of the tests and not how to proceed. The tests described are not exhaustive. In the two right hand columns the crosses (X) indicate the type tests and routine tests normally carried out. The final content of the type tests and routine tests depend on the status of the train or individual vehicle and/or brake system (e.g. new or modified).

Refer to Annex B for a typical static test as applicable to a vehicle fitted with a conventional UIC type air brake for freight trains.

Table 1 — List of static tests

Clause number	Designation of the tests	Type test	Routine test	T (Train / multiple unit) I (Individual vehicle / single unit)
5.4.2	Availability of energy supply			
5.4.2.2	Energy delivery and storage			
5.4.2.2.2	Charging test	X	X	T / I
5.4.2.2.3	Safety test	X	X	T / I
5.4.2.2.4	Energy supply control	X	X	T / I
5.4.2.2.5	Successive applications of the brake (inexhaustibility)	X		T / I
5.4.2.2.6	Electrical supply test	X	X	T / I
5.4.2.3	Energy loss			
5.4.2.3.2	Main reservoirs and all systems supplied by those reservoirs	X	X	T / I
5.4.2.3.3	Auxiliary/brake supply reservoirs/accumulators, brake cylinders and associated devices	X	X	T / I
5.4.2.3.4	Brake pipe	X	X	T / I
5.4.3	Brake control			
5.4.3.2	Interfaces of the brake system with safety related systems	X	X	T / I
5.4.3.3	Check of brake control signals and resultant reactions	X	X	T
5.4.3.4	Check that the brake application command is not adversely affected by the energy supply during braking	X	X	T
5.4.3.5	Emergency brake: levels, timings and time interlocking	X	X	T
5.4.3.6	Service brake application and release: levels and timings	X	X	T
5.4.3.7	Service brake: graduability, stability and repeatability	X	X	T
5.4.3.8	Loss of control of distributor control reservoir pressure	X	X	T / I
5.4.3.9	Pressure switches or equivalent devices	X	X	T
5.4.3.10	Isolation of sub-systems from the brake system at vehicle level	X	X	T
5.4.3.11	Verifying the effects of variation to system setting (e.g. G/P timings)	X	X	T / I
5.4.3.12	Automatic function – Loss of brake system continuity	X	X	T
5.4.3.13	Automatic function – Critical reduction in stored braking energy	X	X	T
5.4.3.14	Load dependent function	X	X	T / I
5.4.3.15	Effectiveness of brake system protection devices	X	X	T

Clause number	Designation of the tests	Type test	Routine test	T (Train / multiple unit) I (Individual vehicle / single unit)
5.4.3.16	Push button operation	X	X	T / I
5.4.3.17	Wheel slide protection (functions and interfaces)	X	X	T / I
5.4.3.18	Sanding system (functions and interfaces)	X	X	T / I
5.4.3.19	Immobilisation braking (holding and parking brake)	X	X	T / I
5.4.3.19.2	Holding brake - Type testing	X	X	T / I
5.4.3.19.3	Parking brake – Type testing	X	X	T / I
5.4.3.19.4	Push-through test	X	X	T / I
5.4.4	Brake application system tests	X	X	T / I
5.4.5	Monitoring devices	X	X	T / I
5.4.6	Accessibility in service and during maintenance	X	X	T / I
5.4.7	Cab interlocking	X	X	T

5.4 Tests conditions and test requirements

5.4.1 General

The following subclauses describe in more detail the tests listed in the Table 1.

As a minimum, the following tests shall be conducted at various load conditions of the vehicle/train. The definition of the load conditions to be used is as contained in EN 15663.

— Vehicles without load dependant brake control shall be tested in state "operational mass, in working order". Herein after referred to as “empty” for the purpose of this standard.

— Vehicles equipped with a load dependant brake control shall be tested in the states "operational mass in working order" and "design mass under exceptional payload". Herein after referred to as “loaded” for the purpose of this standard.

Load conditions may be simulated using mass dummies or equivalent means for obtaining the required load per unit area.

Alternatively, and in the case of intermediate load conditions, loading can be simulated by using other methods, for example, by reproducing the load/weigh signal input to the brake control system, using an independent pressure regulator, or mechanically pressing on the primary suspension.

NOTE The number of intermediate conditions of loads should be defined by the brake system specification.

5.4.2 Availability of energy supply

5.4.2.1 General

The energy supply systems for pneumatic, hydraulic and electrical equipment shall be tested separately as applicable.

The following tests, mentioned in 5.4.2.2 and 5.4.2.3, cover the different functional interfaces between the braking system and the energy supply systems.

5.4.2.2 Energy delivery and storage

5.4.2.2.1 General

The vehicle and/or train to be tested shall be prepared so that it is in a state of readiness for service (e.g. all isolating devices are in their running positions) and with the applicable system/equipment load and working conditions (e.g. compressor motor electrical supply voltage, diesel engine operating at idle speed) as defined in the brake system specifications. Ordinarily these tests are carried out with the vehicle/ train in the tare condition.

The relevant pressures and signals shall be measured and recorded during the tests according to the brake system specification.

5.4.2.2.2 Charging test

For air/hydraulic systems a pump up test (energy charging test) shall be performed whilst observing pressures and times until such time as the system is fully pressurised and the compressors/pumps have stopped delivering energy.

The time achieved to put the vehicle in a pressure or energy state, such that from a brake system status point of view the vehicle/train is “ready to be driven”, shall be recorded. Ready to be driven is typically identified for example by the achievement of a minimum pressure in the brake supply reservoir, or other brake energy level, to ensure that full brake applications can be achieved prior to the vehicle being driven.

The charging of the systems shall be continued noting the time at which the full system pressure is achieved, as signalled by the stopping of the relevant compressor/pumps.

5.4.2.2.3 Safety test

Protection against overload of energy storage shall be checked by means described in the test procedure.

5.4.2.2.4 Energy supply control

Energy consumption shall be simulated to check that the compressor/pumps management automatically maintains the specified service pressure.

An energy user shall be introduced in the system such that the air/hydraulic system is observed to replenish the energy system pressure to maintain the required energy status.

5.4.2.2.5 Successive applications of the brake (inexhaustibility)

Commencing with the specified working pressures for the pneumatic energy supply the specified number of successive application (of the emergency or full service brake dependant on the brake system specification) shall be carried out, and it shall be confirmed that the pressures in the brake cylinder and other braking equipment including magnetic track brake lowering cylinders if applicable, are within the range defined in the brake system specification.

5.4.2.2.6 Electrical supply test

The electrical energy supply for electro-pneumatic, electric braking (e.g. utilising the traction motors), magnetic track brakes and eddy current brakes shall be checked according to the tests procedure.

5.4.2.3 Energy loss

5.4.2.3.1 General

The energy loss (leakage) from the brake system and all other systems that derive their energy from the same energy source shall be tested. The energy loss shall be monitored during a specified time according as identified in the brake specification.

As applicable, the energy loss tests are performed when brakes are applied and released.

As necessary, the energy supply to the subsystem to be tested shall be isolated to facilitate the testing.

5.4.2.3.2 Main reservoirs and all systems supplied by those reservoirs

With the various items of pneumatic equipment under pressure (except those intentionally designed to have certain inherent leaks but not in operation), the main reservoir pressure shall be checked in order that the stored energy is kept without feeding within the tolerances defined in the brake specification.

5.4.2.3.3 Auxiliary/brake supply reservoirs/accumulators, brake cylinders and associated devices

With the brake and energy supply system pressurised to the level(s) defined in the brake system specifications and the brake released, apply the emergency brake and then isolate the reservoir(s/accumulators) from the energy supply in such a way that:

— no further energy can be admitted into the reservoir/accumulators;

— the means normally used for admitting energy into the reservoir/accumulators are depressurised on the energy supply side;

— the remaining subsystem under test is the reservoir/accumulator, brake actuation equipment, pressure control devices (e.g. brake distributor) and any non return devices between this subsystem and the energy supply.

The pressure drop in the reservoir or accumulator and the brake actuation equipment shall remain equal or lower than the leakage limits (pressure drop versus time) defined in the brake system specifications.

5.4.2.3.4 Brake pipe

Where applicable the brake pipe leakage shall be tested. All devices supplied by the brake pipe shall be connected. The driver's brake valve shall be isolated. The pressure drop in the brake pipe shall remain equal or lower than the leakage limits (pressure drop versus time) defined in the brake system specifications.

5.4.3 Brake control

5.4.3.1 General

The tests are applicable for all types of brake systems (pneumatic, hydraulic, electric).

The objective is to establish that the system as a whole and all control components function correctly as described in the brake system specification in association with the energy supply system.

5.4.3.2 Interfaces of the brake system with safety related systems

All safety related systems that have an interface with the brake system, not covered by the specific requirements elsewhere in 5.4.3 shall be tested in accordance with the brake system specification. As a minimum, the systems listed below shall be checked in order to ensure that these systems initiate automatic brake application:

— Brake system safety loop;

— Automatic vigilance equipment;

— Door system;

— Passenger alarm;

— Automatic train protection;

— Speed regulation.

5.4.3.3 Check of brake control signals and resultant reactions

When the braking is initiated, the effects on braking shall be checked.

For all brake application modes, the interaction of signals for brake demand and traction control shall be checked.

The input signals and corresponding output signals shall be checked for the following:

a) Emergency brake (see 5.4.3.5)

The check shall be conducted for each mode of application i.e. by the driver and by all automatic safety systems.

b) Service brake (see 5.4.3.7)

c) Immobilisation brake (see 5.4.3.22)

5.4.3.4 Check that the brake application command is not adversely affected by the energy supply during braking

A full service brake shall be applied; it is necessary to ensure that the brake does not release over a time period as defined in the brake system specification. Any undemanded change of the brake control command, e.g. increase in brake pipe pressure or spurious electrical signal resulting in the brake application being released, shall be investigated.

5.4.3.5 Emergency brake: levels, timings and time interlocking

If more than one type of brake equipment (e.g. friction brakes and track brakes) is used in emergency braking, then tests shall be conducted for all combinations of these, allowing for the possible failure or non-availability of any of these.

The following emergency brake checks shall be conducted:

— check that the brake pipe pressure (or equivalent) commences at the maximum level and tolerance indicated in the brake system specifications;

— check load signals.

Apply the emergency brake:

— check brake cylinder pressures (or equivalent);

— check brake application times;

— check brake release time(s).

5.4.3.6 Service brake application and release: levels and timings

The following service brake checks shall be conducted using the “full service” braking demand:

— check that the brake pipe (or equivalent) commences at the maximum level and tolerance indicated in the brake system specifications;

— check load signals;

— check brake cylinder pressures (or equivalent);

— check brake application time(s);

— check brake release time(s).

5.4.3.7 Service brake: graduability, stability, repeatability

The service brake testing of graduability, stability and repeatability shall be conducted at different simulated load defined by the brake system specification. If more than one type of braking equipment is used in service braking, then tests shall be conducted for all combinations of these.

Where the system incorporates a speed dependant brake level, and/or an electro-dynamic brake, these electrical control signals may be simulated during this test to confirm their correct function.

5.4.3.8 Loss of control of distributor control reservoir pressure

The purpose of these static tests is to check the consequences in case of this control loss; the check shall be undertaken only where this control is present.

The following shall be checked:

— Time to fill the distributor control chamber to (90 % of) its working pressure;

— Evolution of the control reservoir pressure during different operational conditions (e.g. brake application sensitivity / insensitivity, brake release conditions);

— The stability of the pressure value in the distributor control chamber during a brake sequence; this can be checked by measuring the pressure value or by measuring the output pressure of distributor valve keeping the brake pipe pressure constant.

5.4.3.9 Pressure switches or equivalent devices

The purpose of this test is to confirm that the switching values correspond to the requirements of the brake system specification. The switching characteristics shall be determined for both rising and falling pressures.

5.4.3.10 Isolation of sub-systems from the brake system at vehicle level

Where fitted, the correct installation and functionality of isolating devices shall be checked.

5.4.3.11 Verifying the effects of variation to system setting (e.g. G/P timings)

The purpose of these tests is to check the correct functionality of brake in each brake setting and to check the switching devices and functionality when fitted.

Brake application and release times shall be checked during an emergency brake application conducted in each brake setting.

Measurements shall be carried out for the load states e.g. empty, loaded and for each brake setting (G, P, R, R+Mg).

Brake application time is the time to achieve a certain value of max energy level (e.g. 95 % of the cylinder pressure).

The measurement of the brake release time begins with the first reduction of the control demand until a certain level of energy is reached (e.g. 0,4 bar pneumatic brake).

5.4.3.12 Automatic function – Loss of brake system continuity

The purpose of these tests is to check the consequences in the event of brake system continuity loss.

5.4.3.13 Automatic function – Critical reduction in stored braking energy

The purpose of this test is to ensure that when a critical minimum level of stored energy is reached then the brake system automatically applies the brake.

5.4.3.14 Load dependent function

The purpose of these tests is to check the correct function between load conditions and load signals as required.

The behaviour of this functionality shall also be tested for the case of a missing load signal and shall be as defined in brake system specifications.

During the brake application, the vehicle load signal (load pressure) and corresponding brake energy level (cylinder pressure) shall be checked for the three following main load conditions:

— Operational mass, in working order;

— Normal payload;

— Design mass under exceptional payload.

The relevant loads stated shall be provided according to 5.4.1 (verification of the load signals during type testing to be based on physical masses).

For routine tests, to avoid loading of the vehicle a simplified form of load simulation may be carried out. This demonstrate that all braking systems are equivalent to those type tested.

5.4.3.15 Effectiveness of brake system protection devices

The purpose of these tests is to check the consequences of a failure of a component e.g. flexible hose, that is protected by a choke fitting in a pneumatic supply. The failure shall be simulated and the resultant effect shall be recorded.

5.4.3.16 Push button operation

This is a check of the operation of the push-button, which is operated by the driver in an emergency situation and shall result in a brake application.

This test shall also check the correct interruption of traction in order to assure that the train stops. This test shall be repeated for all push buttons installed at all cab position.

This command can be transmitted to the train by several different systems. This transmission and their action shall be checked for each of these systems (e.g. venting the brake pipe by the valve in the push button and/or interruption of the electrical security loop).

This test shall also check the application of the brake by placing the driver's brake valve or electrical controller to the "emergency" position.

5.4.3.17 Wheel slide protection (functions and interfaces)

The wheel slide protection shall be tested according to EN 15595 where applicable to static testing.

As a minimum the brake release time and the re-application time shall be confirmed to be in the range defined in the brake system specifications. The devices shall be checked to ensure that they are correctly assigned to the axles concerned. In addition a self test of the WSP shall be conducted.

5.4.3.18 Sanding system (functions and interfaces)

If a sanding system is present, it shall be tested in the static condition.

The following points shall be checked:

— Delivered quantity of sand versus time according to the demand;

— Heating function if provided;

— Automatic timing functions if provided.

5.4.3.19 Immobilisation braking (holding and parking brake)

5.4.3.19.1 General

The correct immobilisation capability of the parking brake system shall be tested to satisfy the requirements of the brake system specification (operating conditions of applied forces, resultant forces and/or gradients achieved).

If the train is maintained stationary for a limited period of time by a holding brake subject to leak (e. g. hydraulic or air brake) the brake shall be applied with maximum force and it shall be verified during a period defined in the brake system specification.

NOTE The durations of the parking and holding brake tests depend on the operating conditions. The requirement concerning the duration is different for the mass transit vehicles.

5.4.3.19.2 Holding brake — Type testing

Where fitted, a type test shall be conducted to determine the ability of the holding brake to hold the train at the required load, on the defined gradient for the specified time under defined conditions.

Where a holding brake is fitted in conjunction with an automatic traction blending system to allow traction power to be applied whilst the vehicle is on a gradient, a test shall be conducted, either statically or as part of the dynamic testing, to ensure that, when traction is applied whilst the vehicle is being held stationary by the holding brake, no roll back occurs. This proves the ability of the blending system.

5.4.3.19.3 Parking brake — Type testing

A test shall be conducted to determine the ability of the parking brake to hold the train, at the required load, on the defined gradient under defined conditions.

If the parking brake is to be used to stop the train dynamically during rescue operations, then the time taken to apply and release the parking brake shall be established as part of the static test. The acceptability of the time established shall be decided by reference to the design specification, if defined. The controls used whilst carrying out this test shall be those intended for use by the operator during rescue operations.

5.4.3.19.4 Push-through test

Where specified, a type test shall be conducted to prove that, if a train shall be moved with the parking brake applied, the wheels will still rotate rather than slide.

5.4.4 Brake application system tests

The aim is to verify that each brake application system (mainly bogie mounted, e.g. friction brake equipment or magnetic brakes when fitted) is properly working and operates in accordance with the brake system specification.

During general application and release of the brakes, it shall be tested that brake forces are satisfactory and correspond to the braking energy levels (e.g. cylinder pressure) and timings.

At least the following shall be checked:

a) Correct adjustment of brake rigging;

b) Slack adjuster, function: clearance, stroke;

c) Position of the mechanical components (blocks or pads) on the wheels or discs;

d) Position of the mechanical components of magnetic brake and the rail in active and non active condition;

e) Application forces in static and simulated dynamic conditions (e.g. by knocking/shaking the brake rigging of caliper assembly);

f) Emergency release and reactivation function of the parking brake.

NOTE For further information concerning friction brake system tests, see EN 50215.

5.4.5 Monitoring devices

The aim is to verify the correct functioning of the monitoring devices. If applicable, the following points shall be checked to establish whether their function corresponds to the brake system specification:

a) Brake/released status for all the types of information present (pneumatic, hydraulic or electrical brake indicators);

b) Gauges' accuracy and installation.

5.4.6 Accessibility in service and during maintenance

The aim is to verify that all the handles, measuring points, indicators and buttons are accessible.

At least, the following shall be checked:

a) Accessibility to the handle of isolating cocks;

b) Readability of gauges and any indicators;

c) Accessibility to the measuring points;

d) Accessibility to the handle of drain cocks;

e) Accessibility to the inlet air service point;

f) Accessibility to the refilling of oil, water, sand, etc.

The exact static testing undertaken will depend on the design of the particular rolling stock.

5.4.7 Cab interlocking

The interlocking function of the cabs, i.e. the interlocking of simultaneously activated cabs, shall be checked from each cab. These tests shall be done from each end cab if applicable.

6 Documentation

6.1 General

The verification of the brake function and performance against the specified requirements in appropriate standards shall be fully documented.

The documentation for each test shall include:

— Test procedure;

— Test report.

6.2 Test procedure

The test procedure shall describe the method of tests including the acceptance criteria and the information to be recorded in the associated test report.

The test procedure shall contain the following:

a) Purpose of the testing;

b) Reference and issue of the associated performance calculation;

c) Train configuration, i.e. the arrangement and vehicle types in the test formation;

d) Loading condition(s) under which the tests are to be performed;

e) Environmental conditions under which the test shall be performed;

f) Testing equipment. The test equipment required to perform the test shall be defined, e.g. the measurement devices, brake triggering. The instrument setting parameters, e.g. response time, filtering, resolution and accuracy shall be defined;

g) Test personnel skills. The skills of personnel required to perform the test shall be defined;

h) Test description. The test procedure shall be fully detailed including those parameters which shall be recorded;

i) The conditions for conformance with specific acceptance criteria shall be adequately defined, e.g. by stating the desired value including tolerances.

6.3 Test report

The test report shall include all of the information required by the test procedure together with the results of the tests. Any deviations from the test procedure shall be identified. The report shall include a clear statement as to whether the tests acceptance criteria were achieved or not.

The structure of the test report shall reflect that of the test procedure stated in 6.2. Sufficient information shall be included in the report to avoid the need to continually refer to the test procedure.

In addition the report shall include specific reference to the vehicles used in the test and the status of components and software which influence the braking performance of the train, e.g. software issue, component modification level.

The test report document identity shall be stated, i.e. number, revision, date, approved by responsible person.

For each test or series of tests, the report shall record the following as a minimum:

— Date of tests,

— Test location,

— Environmental conditions,

— Results; all related graphics required to demonstrate compliance with technical specifications of the contract,

— Acceptance criteria,

— Names and functions of personnel present during the test.

Prior to any static testing, all necessary system integration and constructional tests shall have been successfully completed.

Annex A
(informative)

Non exhaustive list of components of an air brake system

The brake systems considered incorporate the following components and sub-systems; it should be noted that this list is not definitive and the components fitted to the vehicle(s) is dependent on the brake control system and activation type:

a) Brake control systems

b) Driver's brake valve

c) Brake control instruments, lamps and gauges

d) Driver's emergency brake

e) Track brake

f) Parking brake

g) Interfaces like sanding system and horns

h) Distributor valves

i) Brake discs, pads, blocks, holding devices, cylinders

j) Wheel slide protection equipment

k) End cocks

l) Passenger alarm system

m) Brake indicators

n) Pneumatic half coupling

o) Weighing valve

p) Slack adjusters

q) Relay valve for rolling stock

r) Brake pipe accelerator valve

s) Empty-loaded changeover devices

t) Automatic variable load sensing devices

u) Magnetic track brakes and eddy current brakes

Annex B
(informative)

Example of brake system static tests — Conventional air brakes for freight trains

B.1 Brake systems testing

The tests and limits shown in Table B.1 below apply to vehicle fitted with conventional UIC type air brake for freight trains.

These tests represent only the minimum and common part to assess conventional air brakes for freight trains. Added tests could be conducted to assess the conformity and/or suitability for use according to all the brake requirements of the relevant brake system design specification.

Tests listed in the Table B.1 are done based on a separate vehicle when stationary or on a stationary train.

B.2 Test requirements

The test shall be done only in the single pipe mode. Tests with the auxiliary reservoir filled permanently from the main reservoir pipe shall also to be carried out to demonstrate that the brake operation is not adversely affected.

The normal working pressure (regime pressure) of the conventional air brake is (5 +/- 0,05) bar. The tests are to be done at this pressure. Additionally sample tests shall be done to assure that the operation of the brake is not adversely affected, with a decrease or an increase in this working pressure not exceeding 1 bar.

The tests are to be conducted in the “passenger” and “goods” brake modes, when fitted.

Where variable or empty load braking systems are fitted, the tests shall be carried out in the “loaded” and “empty” positions.

B.3 Minimum brake system tests

Table B.1 below summarises the brake characteristic that is being tested with the pass fail criteria shown as a limit value. The notes in the last column of the Table give further information regarding the method of the individual tests.

Table B.1 — Pneumatic Brake Characteristics Testing

No	Characteristic	Limit Value	Notes
1	Fill time of the brake cylinder to 95% maximum pressure	Passenger Setting 3-5 seconds (3-6 seconds in the case of an empty/load system) Goods Setting 18-30 seconds	The timings shall be obtained from an emergency application on a single vehicle. Following inshot to 10% of the final brake cylinder pressure, the increase in pressure shall be progressive. The filling time from when air commences to fill the cylinder to when the pressure reaches 95% of the final value shall be as stated.
2	Release time of the brake cylinder to 0.4 bar pressure	Passenger Setting 15-20 seconds For freight wagons with a total weight of 70 tonnes or greater, the release time can be 15 to 25 seconds. Goods Setting 45-60 seconds	At the time of full and continuous release of the brake on a separate vehicle following an emergency application, the pressure in the brake cylinder must fall progressively. The release time, measured from when air commences to be exhausted from the cylinder, to when the pressure reaches 0.4 bar shall be as stated.
3	Reduction in brake pipe pressure required to obtain maximum brake cylinder pressure	1,5 ± 0,1 bar	In order to obtain maximum brake cylinder pressure, the brake pipe pressure shall be reduced by 1,4 to 1,6 bar below the regime pressure.
4	Maximum brake cylinder pressure	3,8 ± 0,1 bar	The maximum brake cylinder pressure obtained from a reduction in brake pipe pressure of 1,4 to 1,6 bar shall be 3,7 to 3,9 bar.
5	Sensitivity/Insensitivity The insensitivity of the brake to slow decreases in brake pipe pressure shall be such that the brake is not activated if the normal working pressure drops by 0,3 bar in one minute. The sensitivity of the brake to decreases in brake pipe pressure shall be such that the brake is activated within 1,2 seconds if the normal working pressure drops by 0,6 bar in 6 seconds.	Brake does not activate with a 0,3 bar drop in one minute. Brake activates within 1,2 seconds with a 0,6 bar drop in 6 seconds.	The insensitivity of the brake to slow decreases in brake pipe pressure shall be such that the brake is not activated if the normal working pressure drops by 0,3 bar in one minute. The sensitivity of the brake to decreases in brake pipe pressure shall be such that the brake is activated within 1,2 seconds if the normal working pressure drops by 0,6 bar in 6 seconds.
6	Brake pipe leakage from a starting pressure of 5 bar	0,2 bar maximum pressure loss in 5 minutes	High-pressure overcharge to 6 bar brake pipe pressure.

No	Characteristic	Limit Value	Notes
7	Brake cylinder, auxiliary reservoir and control reservoir leakage from a starting Brake Cylinder pressure of 3,8 + or – 0,1 bar from a brake pipe pressure of 0 bar	0,15 bar maximum pressure loss in 5 minutes	With the brake pipe at 0 bar, equalise the auxiliary reservoir and brake cylinder pressure, and ensure overall leakage does not exceed that stated.
8	Manual release of the automatic air brake.	Brake releases	The brake must have a device allowing manual brake release.
9	Graduability in application and release variations in brake pipe pressure:	Less or equal to 0,1 bar.	The brake shall be such that the pressure in the brake cylinder is always in keeping with variations in the brake pipe pressure. A pressure variation of +/- 0,1 bar in the brake pipe shall give rise, from the distributor, a corresponding variation in the brake cylinder, after the brake starts working. For one value of brake pipe pressure, the brake cylinder pressure shall not vary by more than 0,1 bar during application and release. (For braking via pneumatically controlled relay valves for braking power variation, the 0,1 bar value applies to the dummy cylinder pressure.)
10	Pressure corresponding to the return to the filling position at the time of brake release	Brake Pipe : 4,85 bar Brake cylinder : 0,3 bar	
11	Automatic air brake indicator	Ensure the indicator reflects the brake state – applied or released	Wagons where the automatic air brake application/release state cannot be checked without going beneath the wagon (for example those fitted with axle mounted disc brakes) shall be fitted with an indicator showing the state of the automatic brake.
12	Slack adjuster to be tested by creating an excessive brake friction pair gap and demonstrating that repeated application/release cycles restore correct clearance	Design brake friction pair pad/block clearance	Correct slack adjuster operation shall be confirmed by creating an excessive brake friction pair gap, demonstrating that repeated application/release cycles restore the correct clearance.
13	Compliance to design brake pad/block loads	Brake pad/block loads shall comply with design	On the first-off of a build of wagons, the brake pad or block application force shall be measured to confirm that it complies with the design.
14	Brake rigging shall be free to move and allow brake pads/blocks to clear the brake discs/wheels in the released state and not reduce application forces below design	Brake rigging shall be free	Brake rigging shall be free such that the pads/blocks clear the brake discs/wheels in the released state, and application forces are not reduced below design.

No	Characteristic	Limit Value	Notes
15	Parking brake components shall be free moving and lubricated if required	Free movement: ensure that it applies and releases without binding.	Parking brake components, rigging, leadscrews and nuts etc, shall be free moving and lubricated if required by the design.
16	Control and performance of the parking brake shall be such that with 500 N force applied to the end of a brake lever or tangentially to a hand wheel rim	500 N force applied	On the first off of a build of wagons, the vehicle retarding force shall be measured resulting from a 500 N input force at the end of a parking brake lever, or applied tangentially to a handwheel rim. The force measured shall comply with the design.
17	Manual release of the parking brake	Parking Brake releases	The parking brake shall be applied and released manually, not adversely affecting the friction pair gap in the released state.
18	Immobilisation brake indicator shall reflect state of brake	Indicator shall accurately show the brake state – applied or released	A parking brake indicator shall be fitted which accurately reflects the status of the parking brake, applied or released.

The tests procedures shall conform to the European standards.

For freight wagons equipped with “R” braking mode specific tests must be done. These tests shall conform to the European standards.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC

This European Standard has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Directive 2008/57/EC[1)].

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 for CR Freight Wagons confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

1) This Directive 2008/57/EC adopted on 17th June 2008 is a recast of the previous Directives 96/48/EC 'Interoperability of the trans-European high-speed rail system' and 2001/16/EC 'Interoperability of the trans-European conventional rail system' and revisions thereof by 2004/50/EC 'Corrigendum to Directive 2004/50/EC of the European Parliament and of the Council of 29 April 2004 amending Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system'.

Table ZA.1 — Correspondence between this European Standard, the CR TSI RST Freight Wagon dated July 2006, published in the OJEU on 8 December 2006 and its intermediate revision published in the OJEU on 14 February 2009 and Directive 2008/57/EC

Clause/ subclauses of this European Standard	Chapter/§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
Clauses 1 to 6 inclusive Annex B of the standard are applicable	4 Characterisation of the subsystem 4.2 Functional and technical specifications of the subsystem 4.2.4 Braking 4.2.8 Maintenance file 4.3 Functional and technical specifications of the interfaces §4.3.2.4 Control and command and signalling subsystem - Braking §4.3.3.7 Traffic operation and management subsystem – Braking performance 5 Interoperability constituents §5.3.3.8 List of constituents, Braking, Isolating device for distributor 6 Assessment of conformity and/or suitability for use of the constituents and verification of the subsystem §6.2.3.3 Subsystem conventional rail rolling stock freight wagons, Specification for assessment of the subsystem – Braking Annex S Braking, Braking performance	Annex III, Essential requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3, 1.1.5 1.2 Reliability and availability 1.5 Technical compatibility 2 Requirements specific to each subsystem 2.3 Control-command and signalling 2.3.2 Technical compatibility§1 2.4 Rolling stock 2.4.1 Safety §3 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3 2.6 Operation and traffic management 2.6.1 Safety §2	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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[2] EN 13452-2, *Railway applications — Braking — Mass transit brake systems — Part 2: Methods of test*

[3] EN 14198, *Railway applications — Braking — Requirements for the brake system of trains hauled by a locomotive*

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[5] FprEN 15734-1, *Railway applications — Braking system of high speed trains — Part 1: Requirements and definitions*

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[7] EN 50215, *Railway applications — Testing of rolling stock after completion of construction and before entry into service*

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[9] UIC 544-1, *Brakes — Braking power*

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[11] Verordnung über den Bau und Betrieb der Straßenbahnen (BOStrab, 11 Dez. 1987), Germany (German Federal Regulations on the construction and operation of light rail transit systems; BOStrab, issued 11th December 1987), § 36 Braking

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