BRITISH STANDARD

BS EN 15625:2008
+A1:2010

Railway applications — Braking — Automatic variable load sensing devices

ICS 45.060.01

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15625:2008+A1:2010. It supersedes BS EN 15625:2008, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1] 〈A1〉.

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

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

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This European Standard was approved by CEN on 13 September 2008 and includes Amendment 1 approved by CEN on 30 August 2010.

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Foreword

This document (EN 15625:2008+A1:2010) 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of an identical text or by endorsement, at the latest by April 2011, and conflicting national standards shall be withdrawn at the latest by April 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1, approved by CEN on 2010-08-30.

This document supersedes EN 15625:2008.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] 〈A1〉.

[A1] This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document. 〈A1〉

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard applies to automatic variable load sensing devices designed to continuously sense the load of a railway vehicle and provide a signal that can be used by a relay valve for the automatic variation of the air pressure used for brake application, thereby adjusting the brake force accordingly to achieve the required brake performance.

This European Standard specifies the requirements for the design, dimensions, manufacture and testing of automatic variable load sensing devices.

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

EN 60721-3-5:1997, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Section 5: Ground vehicle installations (IEC 60721-3-5:1997)*

EN 61373:1999, *Railway applications — Rolling stock equipment — Shock and vibration tests (IEC 61373:1999)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

ISO 8573-1:2001, *Compressed air — Part 1: Contaminants and purity classes*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1.1
automatic variable load sensing device
weighing device
device connected to the vehicle, which responds to the loading of that vehicle to provide a continuous load proportional signal to the brake control device

NOTE The load input is normally a share of the wagon's mass because of the devices position in the vehicle suspension system. The result is a pneumatic output signal pressure that can be any value between a minimum at tare mass and a maximum at maximum mass. Most of the existing self-adjusting load-dependant brakes generate the load signal using a weighing device.

3.1.2
mechanically operated pneumatic device
device or mechanism having both mechanical and pneumatic elements

3.1.3
hydraulic to pneumatic converter
device or mechanism which transforms the hydraulic pressure generated by the mass of the vehicle into a pneumatic pressure with a defined transmission ratio

3.1.4
elastomeric to pneumatic converter
device or mechanism having both elastomeric and pneumatic components, which transforms the pressure in the elastomer generated by the mass of the vehicle into a pneumatic pressure with a defined transmission ratio

3.1.5
output signal pressure
load continuous pressure
Lcp
output pressure delivered by the automatic variable load sensing device, which signals the load of the vehicle to the brake control mechanism

3.1.6
supply pressure
input pressure of the air supply to a pneumatic automatic variable load sensing device

NOTE Typically supplied from the vehicle's distributor auxiliary reservoir, or from the vehicle distributor output pressure/brake cylinder pressure system.

3.1.7
normal litre
Nl
unit of mass for gases equal to the mass of 1 l at a pressure of 1,013 2 bar (1 atmosphere) and at a standard temperature, often 0 °C or 20 °C

NOTE Airflow is often stated in normal litres per minute (Nl/min).

3.1.8
sensitivity
minimum change of load which causes a variation of the output signal pressure (*Lcp*), when the change of load (input) is in the same direction

3.1.9
hysteresis
difference in output signal pressure (*Lcp*) with the same load, where the load is first rising to a value and then, having been taken past that value, subsequently falls to the same value

3.2 Symbols

F [kN] mechanical force, generated by the share of vehicle weight acting at the automatic variable load sensing device

4 Design and manufacture

4.1 General

The design and manufacture of the automatic variable load sensing device shall, for all intended operating conditions, take into account the following requirements.

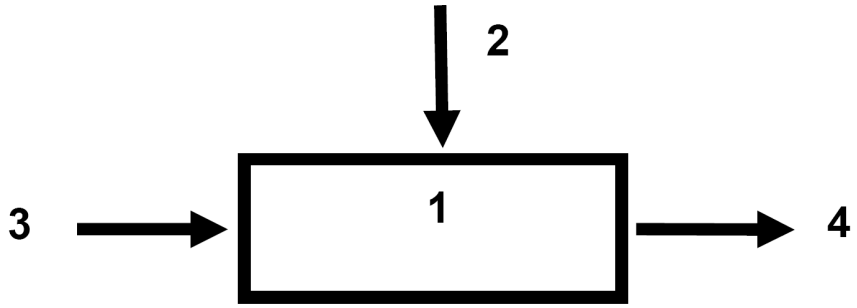
4.2 Functional requirements

4.2.1 Operating requirements

The automatic variable load sensing device shall, in all cases, supply a pneumatic output signal pressure (*Lcp*) which is a function of the load. The transmission of this load signal to the brake control system shall be pneumatic.

The method of producing the pneumatic signal *Lcp* can be a mechanically operated pneumatic device, a hydraulic to pneumatic converter or an elastomeric to pneumatic converter.

Figure 1 indicates the principles of operation of an automatic variable load sensing device.



Key

1 automatic variable load sensing device

2 *F*, mechanical force, generated by a share of the vehicle weight

3 supply pressure, typically taken from the distributor auxiliary reservoir

4 *Lcp*, output signal pressure

Figure 1 — Principles of operation of the automatic variable load sensing device

4.2.2 Characteristics of weighing valves

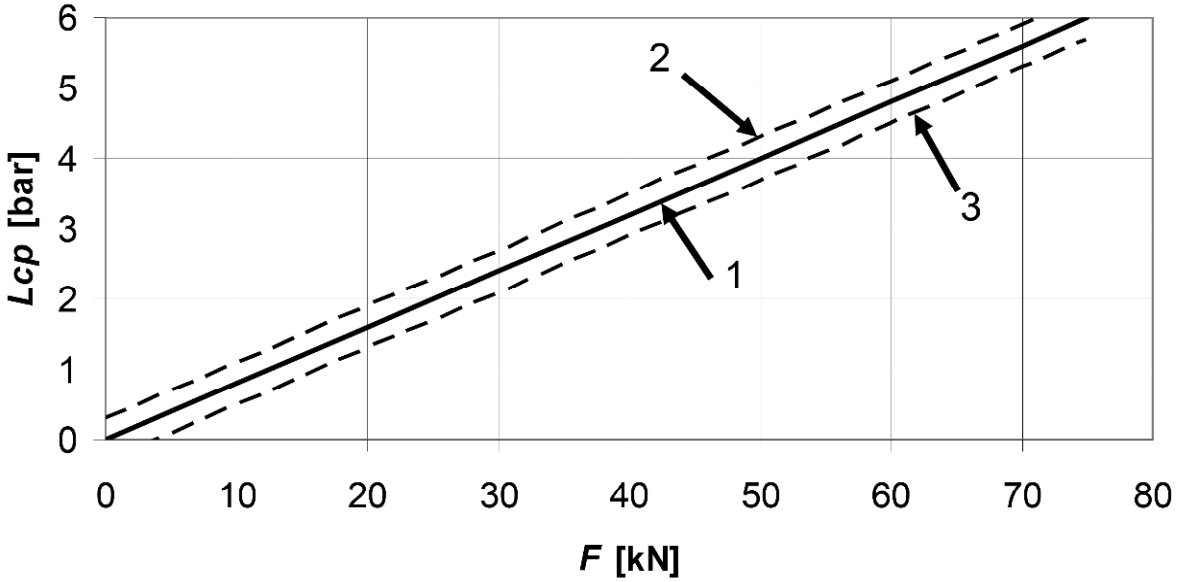
Two characteristics of weighing valves are defined:

— type 1: (0,8 ± 0,1) bar/10 kN (see Figure 2);

— type 3: (1,0 ± 0,1) bar/10 kN (see Figure 3).

The characteristics for type 1 and type 3 shall be tested in accordance with 6.2.6.

NOTE These types are recommended for new interoperable freight wagons. For applications other than interoperable freight wagons other characteristics may be used by agreement between the manufacturer and the customer.



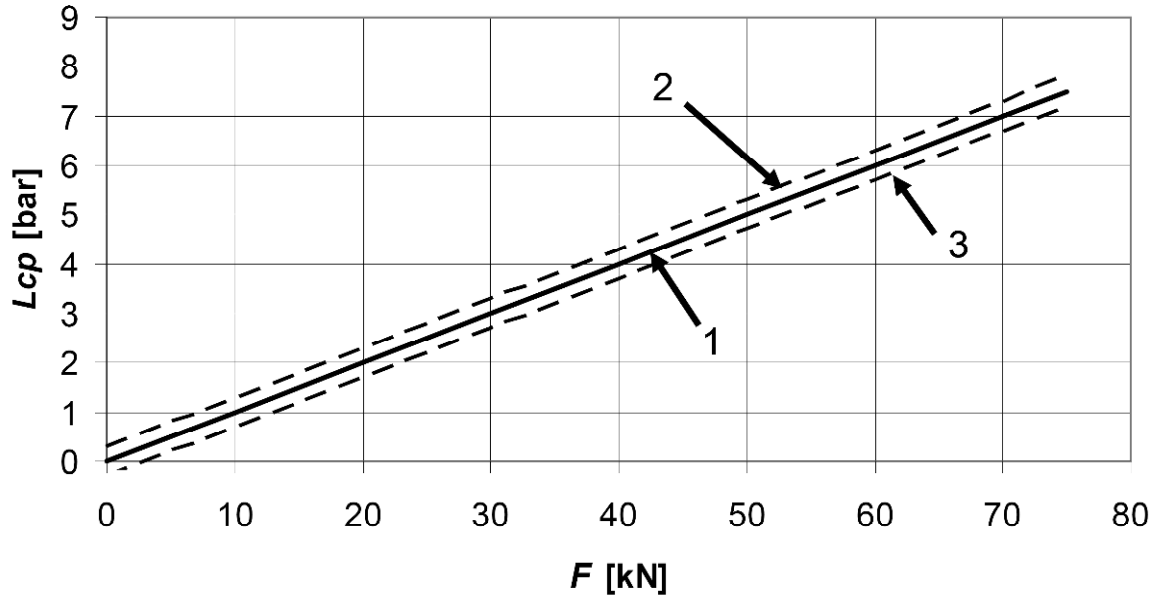
Key

1 characteristic (nominal value)

2 upper limit of tolerance

3 lower limit of tolerance

Figure 2 — Characteristic of the automatic variable load sensing device type 1



Key

1 characteristic (nominal value)

2 upper limit of tolerance

3 lower limit of tolerance

Figure 3 — Characteristic of the automatic variable load sensing device type 3

4.2.3 Mechanical requirements

The automatic variable load sensing device shall be designed to operate with at least a static force *F* of 60 kN without any damage or change of its characteristic. This shall be tested in accordance with 6.2.6.

4.2.4 Leakage

The sealing arrangement within the automatic variable load sensing device shall prevent any unacceptable loss of air.

At of (20 ± 5) °C the automatic variable load sensing device shall not have a leakage rate greater than 0,005 Nl/min at the normal working pressure. This requirement shall be tested in accordance with 6.2.5.2, 6.2.5.3 and 6.2.5.4.

At an environmental temperature of – 25 °C, also at + 70 °C, the automatic variable load sensing device shall not have a leakage rate greater than 0,01 Nl/min at the normal working pressure. This requirement shall be tested in accordance with 6.2.7.2, 6.2.7.3 and 6.2.7.4.

At – 40 °C ≤ environmental temperature < – 25 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,1 Nl/min at the normal working pressure. This requirement shall be tested in accordance with 6.2.7.2, 6.2.7.3 and 6.2.7.4.

4.3 Vibrations and shock

The automatic variable load sensing device shall be able to operate without restriction under vibration and shock conditions as specified by EN 61373:1999, Category 2. This requirement shall be tested in accordance with 6.2.8.

The automatic variable load sensing device shall fulfil the specified requirements during a random vibration test in accordance with EN 61373:1999, Clause 8.

The automatic variable load sensing device shall withstand a simulated long life test at increased random vibration levels in accordance with EN 61373:1999, Clause 9, without any loss of performance.

The automatic variable load sensing device shall withstand shock testing in accordance with EN 61373:1999, Clause 10, without any loss of performance.

The above shall be tested in accordance with 6.2.8.

4.4 Environment

4.4.1 General

The design shall take into account that the automatic variable load sensing device shall be able to be put into service and operate normally in the conditions and climatic zones for which it is designed and in which it is likely to run, as specified in this European Standard.

NOTE 1 The environmental conditions are expressed in classes for temperature etc. thereby giving the vehicle designer the choice of an automatic variable load sensing device suitable for operation on a vehicle all over Europe, or have a restricted use.

NOTE 2 The environment range limits specified are those that have a low probability of being exceeded. All specified values are maximum or limit values. These values may be reached, but do not occur permanently. Depending on the situation there can be different frequencies of occurrence related to a certain period of time.

NOTE 3 The environment requirements of this European Standard cover the environment requirements of the HS RST TSI which only refers to EN 50125-1:1999.

The automatic variable load sensing device shall be tested in accordance with requirements given in Clause 6 including where required environmental/climatic testing.

4.4.2 Temperature

The automatic variable load sensing device covered by this European Standard shall be able to operate:

— at – 25 °C ≤ environmental temperature ≤ 70 °C without any deviation from the technical requirements specified in Clause 4;

— at – 40 °C ≤ environmental temperature < – 25 °C with allowed deviation from the technical requirements specified in this European Standard but without affecting the function of the automatic variable load sensing device.

Deviations from the technical requirement when testing at extremes are defined in 6.2.7.

The purchaser can specify higher or lower extreme temperature limit values if operational constraints demand it. In this case the temperature limit values used in the extreme temperature tests of 6.2.7 shall be changed accordingly.

4.4.3 Other environmental conditions

4.4.3.1 General

The following environmental conditions shall be considered in the design of the automatic variable load sensing device.

It shall be demonstrated that these environmental conditions have been taken into account in the design of the automatic variable load sensing device. It is sufficient for the supplier to make a declaration of conformity stating how the environmental conditions in the following clauses have been taken into account.

If not specifically required to be tested as part of the type testing requirements in Clause 6, suitable tests and/or design assessments considering the effect of the following environmental conditions on the automatic variable load sensing device, shall be used in the development/design proving of the automatic variable load sensing device, prior to type testing.

4.4.3.2 Altitude

The automatic variable load sensing device shall be able to operate without restrictions up to an altitude of 2 000 m.

4.4.3.3 Humidity

The following external humidity levels shall be considered:

— yearly average: ≤ 75 % relative humidity;

— on 30 days in the year continuously: between 75 % and 95 % relative humidity;

— on the other days occasionally: between 95 % and 100 % relative humidity;

— maximum absolute humidity: 30 g/m^3 occurring in tunnels.

An operationally caused infrequent and slight moisture condensation shall not lead to any malfunction or failure.

The psychometric charts contained in EN 50125-1 shall be used to establish the range of variation of the relative humidity for the different temperature classes that it is considered will not be exceeded for more than 30 days per year.

At cooled surfaces, 100 % relative humidity can occur, causing condensation on parts of equipment; this shall not lead to any malfunction or failure.

Sudden changes of the air temperature local to the vehicle can cause condensation of water on parts of equipment with rate of 3 K/s and maximum variation of 40 K; these conditions particularly occurring when entering or leaving a tunnel shall not lead to any malfunction or failure of the equipment.

4.4.3.4 Rain

Rain rate of 6 mm/min shall be taken into account. The effect of rain shall be considered depending on the possible equipment installation together with wind and vehicle movement.

4.4.3.5 Snow, ice and hail

Consideration shall be given to the effect of all kinds of snow, ice and/or hail. The maximum diameter of hailstones shall be taken as 15 mm, larger diameter can occur exceptionally.

The effect of snow, ice and hail shall be considered depending on the equipment installation together with wind and vehicle movement.

4.4.3.6 Solar radiation

Equipment design shall allow for direct exposure to solar radiation at the rate of 1 120 W/m^2 for a maximum duration of 8 h.

4.4.3.7 Resistance to pollution

The effects of pollution shall be considered in the design of equipment and components. Means may be provided to reduce pollution by the effective use of protection of the automatic variable load sensing device. The severity of pollution can depend upon the location of the equipment therefore the effects of the kinds of pollution indicated in Table 1 shall be considered as a minimum.

Table 1 — Pollution

Pollution	Class to be considered
Chemically active substances	Class 5C2 of EN 60721-3-5:1997
Contaminating fluids	Class 5F2 (electrical engine) of EN 60721-3-5:1997 Class 5F3 (thermal engine) of EN 60721-3-5:1997
Biologically active substances	Class 5B2 of EN 60721-3-5:1997
Dust	Class 5S2 of EN 60721-3-5:1997
Stones and other objects	Ballast and other objects of maximum 15 mm diameter
Sand	Class 5S2 of EN 60721-3-5:1997
Sea spray	Class 5C2 of EN 60721-3-5:1997

4.5 Compressed air quality

It shall be possible to operate the automatic variable load sensing device without restrictions with at least the compressed air quality according to the following classes defined by ISO 8573-1:2001:

— class 4 – for the maximum particle size and the maximum concentration of solid contaminants;

— class 4 – for the water dew point;

— class 4 – for the maximum total (droplets, aerosols and vapours) oil concentration.

The automatic variable load sensing device shall be capable of operating in an air supply system that is not fitted with an air dryer, or when the air dryer is out of order. The air system should therefore include some means of preventing water collecting within the automatic variable load sensing device and hence freezing of the water in conditions below 0 °C.

4.6 Service life

No specific requirements for the automatic variable load sensing device to attain a particular service life are contained in this European Standard.

Any testing to establish the service life of an automatic variable load sensing device shall be conducted as part of the product development.

NOTE The service life of the automatic variable load sensing device is a function of the environment/operating conditions in which the automatic variable load sensing device will function, and the requirements for the automatic variable load sensing device to achieve a serviceable life in accordance with the maintenance requirements of the vehicle to which it is fitted.

4.7 Fire behaviour

The materials used in the manufacture of the automatic variable load sensing device shall prevent the emission of fumes or gases that are harmful and dangerous to the environment, particularly in the event of fire.

The assembled automatic variable load sensing device shall limit fire ignition, propagation and the production of smoke in the event of fire on primary ignition from a source of 7 kW for 3 min.

4.8 External appearance

The dimensions and the co-ordinates and threads of the ports and fixing points of the automatic variable load sensing device shall comply with the details given by the relevant drawing.

The design of the automatic variable load sensing device shall ensure that the exterior surfaces of the automatic variable load sensing device are free of sharp edges and corners that could be dangerous to those people handling the automatic variable load sensing device or, when installed on a vehicle, working on adjacent equipment.

This requirement shall be checked in accordance with 6.2.4.

4.9 Design requirements regarding pressure stress

The automatic variable load sensing device shall be able to withstand a supply pressure of 10 bar.

4.10 Interfaces

4.10.1 Mechanical

The mechanical connection points to the vehicle shall be suitably sized to meet the physical loadings identified in this European Standard.

4.10.2 Pneumatic

The pipe connection threads of the automatic variable load sensing device for the supply pressure and the output signal pressure (*Lcp*) shall be G1/4 in accordance with EN ISO 228-1.

5 Materials

The selection of the material and the manufacturing process are left to the discretion of the manufacturer, however they shall comply with the requirements of this European Standard, technical specification and/or the relevant design drawings.

6 Type tests

6.1 General

The following type tests shall be carried out in order to assess the performance of the automatic variable load sensing device against the requirements of this European Standard.

The type tests shall be conducted and the records shall be kept as evidence of the compliance with this European Standard.

The type tests shall be conducted on individual automatic variable load sensing devices.

All the test requirements shall be achieved to obtain type test compliance.

6.2 Individual automatic variable load sensing device type tests

6.2.1 Test bench for individual automatic variable load sensing devices type tests

The type tests shall be performed on a test bench specifically designed so that all the requirements given by this European Standard for the testing of the automatic variable load sensing device can be performed and compliance with the requirements of 4.2 confirmed.

This test bench arrangement or an equivalent may be used for both ambient and extreme temperature testing when used in association with a thermostatic enclosure. The dimensions and other characteristics of the test bench components shall be provided to ensure the performance of the test bench is in accordance with the requirements of this specification. This shall be verified to ensure that constructional elements of the test bench have not affected that performance.

The test bench shall include:

— precision pressure reducing valve;

— isolating cocks;

— reservoir;

— precision test gauges;

— precision gauge, measuring force *F*;

— force counter bearing.

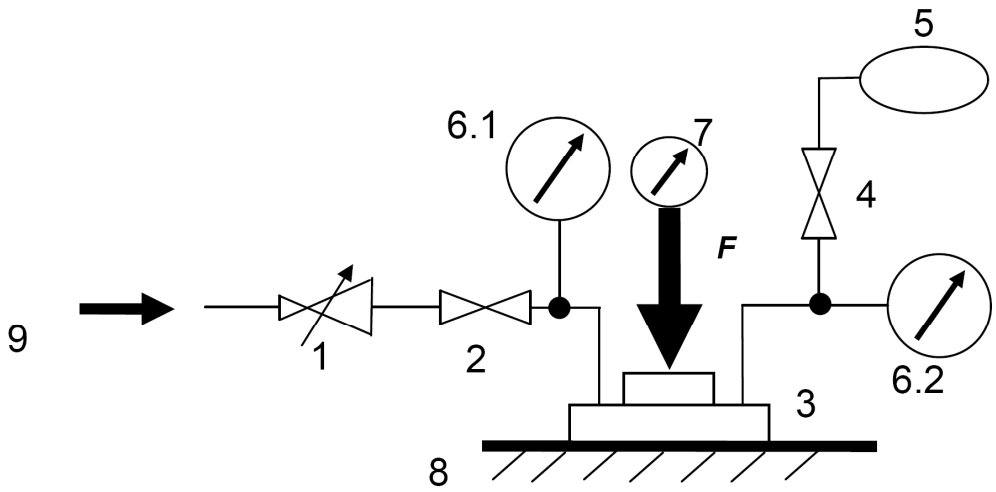
A typical diagram of a test bench that shall be used to show conformity of the automatic variable load sensing device with the requirements of this European Standard is shown in Figure 4.

The measuring instrumentation used on the test bench shall be calibrated and have a maximum deviation of 0,02 bar for the pressure measurement. Pressure tolerances are stated as applicable in the following clauses.

The pipe volume between isolating cock and automatic variable load sensing device, including the pipework to, and the measuring instruments itself shall be known to allow the calculation of the leakage rates.

A suitable air supply shall be provided with a maximum supply pressure of 10 bar.

The test bench leakage shall not be greater than 0,000 1 Nl/min.



Key

1 precision pressure reducing valve
2 isolating cock
3 automatic variable load sensing device
4 isolating cock
5 reservoir 1 litre
6.1 digital precision test gauge air supply pressure
6.2 digital precision test gauge *Lcp*
7 precision gauge, measuring force *F*
8 force counter bearing
9 air supply

Figure 4 — Test bench for individual automatic variable load sensing devices

6.2.2 Sampling for type test

A sample of ten (10) automatic variable load sensing devices shall be taken from the normal production.

6.2.3 Test requirements

The tests described in the following, except the type tests of 6.2.5, shall be performed at (20 ± 5) °C.

All type tests shall be performed with a minimum air quality of the compressed air of class 4-4-4 specified in ISO 8573-1:2001.

All adjustments of the force *F* shall be done at an adjusting rate of between 10 kN/10 s and 10 kN/30 s without overshoot for both increasing and decreasing force if not otherwise stated in the test procedure.

All values of the force *F* stated in the following clauses are nominal values. For each test the nominal value of *F* required shall be set as accurately as possible.

The actual value of *F* achieved shall be recorded and the corresponding value of *Lcp* shall be calculated in accordance with the design characteristic to give the theoretical nominal value. The measured value of *Lcp* shall then be compared with the theoretical value for each force and the measured value of *Lcp* shall be within the tolerance stated in the relevant pass/fail clause.

It is acceptable for the tests to be conducted with a static force or a varying force with a peak-to-peak value of 15 % to 30 % of the nominal force at a frequency of 3 Hz.

The tests on the sample of ten (10) automatic variable load sensing devices shall be carried out in the order shown in Table 2.

Table 2 — Sample testing

Tests	Corresponding standard sub-clause	Tested automatic variable load sensing device number									
		1	2	3	4	5	6	7	8	9	10
Physical and geometrical characteristics	6.2.4	X	X	X	X	X	X	X	X	X	X
Leakage	6.2.5	X	X	X	X	X	X	X	X	X	X
Characteristic, hysteresis	6.2.6	X	X	X	X	X	X	X	X	X	X
Leakage at extreme temperatures	6.2.7.2, 6.2.7.3, 6.2.7.4					X		X			
Sensitivity, characteristic at extreme temperatures	6.2.7.5					X		X			
Shock and vibration	6.2.8					X		X			

6.2.4 Check of physical and geometrical characteristics

6.2.4.1 Procedure

In accordance with the particular order documentation and approval drawings, dimensional accuracy shall be verified by means of appropriate measuring instruments and form gauges e.g. threaded connections may be checked using GO/NOT GO gauges in accordance with EN ISO 228-2. The external surfaces shall be checked for sharp edges and corners.

6.2.4.2 Pass/fail criteria

The result is satisfactory if all the specified characteristics are met and no sharp edges and corners are present on the external surfaces.

6.2.5 Leakage

6.2.5.1 General

The following tests shall be carried out on the test bench shown in Figure 4. Leakage rates are stated in Nl/min. The leakage rate shall be calculated from a measured pressure drop and a known volume inside the automatic variable load sensing device and the pipe of the test bench up to the isolating cock 4.

6.2.5.2 Leakage for *F* = 0 kN

6.2.5.2.1 Procedure

Close isolating cock 4. Adjust the air supply pressure to 7 bar using the pressure reducing valve 1, adjust the force *F* to 0 N as shown on gauge 7 and allow the automatic variable load sensing device on test to charge for 30 s. Close isolating cock 2, check for pressure drop at gauge 6.1 over a period of 1 min.

6.2.5.2.2 Pass/fail criteria

Leakage shall not be greater than 0,005 Nl/min.

Table 3 may be used when determining the leakage.

Table 3 — Pressure change values occurring in a volume of 0,1 l with a leakage rate quoted in Nl/min

Pressure drop at 0,1 l, within 1 min	Escaping air volume, Nl/min
0,01	0,001
0,02	0,002
0,03	0,003
0,05	0,005

6.2.5.3 Leakage for *F* = 10 kN

6.2.5.3.1 Procedure

Open the supply, isolating cock 2, adjust the force *F* to 10 kN and allow the automatic variable load sensing device on test to charge for 1 min. Close the isolating cock 2, check for pressure drop at gauge 6.1 for 1 min. Observe the pressure at gauge 6.2.

6.2.5.3.2 Pass/fail criteria

Leakage shall not be greater than 0,005 Nl/min. While checking, the pressure at gauge 6.2 shall be stable, i.e. the indicated value shall not alter more than ± 0,02 bar.

6.2.5.4 Leakage for *F* = 50 kN

6.2.5.4.1 Procedure

Open the supply, isolating cock 2, adjust the force *F* to 50 kN and allow the automatic variable load sensing device on test to charge for 1 min. Close the isolating cock 2, check for pressure drop at gauge 6.1 for 1 min. Observe the pressure at gauge 6.2.

6.2.5.4.2 Pass/fail criteria

Leakage shall not be greater than 0,005 Nl/min. While checking, the pressure at gauge 6.2 shall be stable, i.e. the indicated value shall not alter more than ± 0,02 bar.

6.2.6 Characteristic, hysteresis

6.2.6.1 Procedure

Open isolating cock 4, with force *F* at 0 kN and output signal pressure *Lcp* at 0 bar. Wait 30 s for settlement and record the value of *Lcp*.

Adjust force *F* to 5 kN, wait 30 s for settlement and record the value of *Lcp*.

Increase the force *F* further to 60 kN in steps as defined in Table 4, wait 30 s after each adjustment, measure and record the output signal pressure *Lcp*.

After measuring the output signal pressure *Lcp* with the load of 60 kN, wait 30 s and repeat the test with decreasing force *F* as defined in Table 4.

Table 4 — Test of characteristic and hysteresis of automatic variable load sensing device

Nominal *F* [kN]	Type 1 - Nominal theoretical design pressure *Lcp_n* [bar]	Type 3 - Nominal theoretical design pressure *Lcp_n* [bar]	Measured pressure *Lcp_r* [bar]
0	0	0	
5	≥ 0,2	≥ 0,2	
10	0,8	1,0	
20	1,6	2,0	
30	2,4	3,0	
40	3,2	4,0	
50	4,0	5,0	
60	4,8	6,0	
50	4,0	5,0	
40	3,2	4,0	
30	2,4	3,0	
20	1,6	2,0	
10	0,8	1,0	
0	0	0	

6.2.6.2 Pass/fail criteria

For *F* = 5 kN the output signal pressure *Lcp* shall be ≥ 0,2 bar within 30 s.

The difference between measured and nominal design pressure shall be ± 0,1 bar in the range above *F* = 5 kN in Table 4 for automatic variable load sensing device for interoperable applications. If another type of device is to be tested the nominal characteristic values for that type shall be used but the same allowed differences apply.

6.2.7 Operation at extreme temperatures

6.2.7.1 General

The following tests shall be conducted on an automatic variable load sensing device at temperatures of - 40 °C, – 25 °C and + 70 °C.

The test shall be conducted with a test bench as shown in Figure 4 located within a suitable climatic chamber except the measuring equipment, e.g. the gauges which shall be mounted outside.

The test arrangement shall be subject to this temperature for 4 h prior to the test commencing. When the air pressure has stabilised and the air itself has been cooled within the climatic chamber prior to reaching the automatic variable load sensing device, conduct the following tests at each temperature.

6.2.7.2 Leakage for *F* = 0 kN

6.2.7.2.1 Procedure

Close isolating cock 4. Adjust the air supply pressure to 7 bar using the pressure reducing valve 1, adjust the force *F* to 0 N as shown on gauge 7 and allow the automatic variable load sensing device on test to charge for 30 s. Close isolating cock 2, check for pressure drop at gauge 6.1 over a period of 1 min.

6.2.7.2.2 Pass/fail criteria

At – 25 °C and at + 70 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,01 Nl/min.

At – 40 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,1 Nl/min.

6.2.7.3 Leakage for *F* = 10 kN

6.2.7.3.1 Procedure

Open the supply, isolating cock 2, adjust the force *F* to 10 kN and allow the automatic variable load sensing device on test to charge for 1 min. Close the isolating cock 2, check for pressure drop at gauge 6.1 for 1 min. While checking, the pressure at gauge 6.2 shall be stable, i.e. the indicated value shall not alter more than ± 0,02 bar.

6.2.7.3.2 Pass/fail criteria

At – 25 °C and at + 70 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,01 Nl/min.

At – 40 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,1 Nl/min.

6.2.7.4 Leakage for *F* = 50 kN

6.2.7.4.1 Procedure

Open the supply, isolating cock 2, adjust the force *F* to 50 kN and allow the automatic variable load sensing device on test to charge for 1 min. Close the isolating cock 2, check for pressure drop at gauge 6.1 for 1 min. While checking, the pressure at gauge 6.2 shall be stable, i.e. the indicated value shall not alter more than ± 0,02 bar.

6.2.7.4.2 Pass/fail criteria

At – 25 °C and at + 70 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,01 Nl/min.

At – 40 °C the automatic variable load sensing device shall not have a leakage rate greater than 0,1 Nl/min.

6.2.7.5 Sensitivity, check of characteristic at extreme temperatures

6.2.7.5.1 Procedure

Open isolating cock 4, with force *F* at 0 kN and output signal pressure *Lcp* at 0 bar, wait 30 s for settlement and record the value of *Lcp*.

Adjust force *F* further to 10 kN, wait 30 s for settlement and record the value of *Lcp*.

Increase the force *F* to 60 kN in steps as defined in the Table 5, wait 30 s after each adjustment, measure and record the output signal pressure *Lcp*.

After measuring the output signal pressure *Lcp* with the load of 60 kN, wait 30 s and repeat the test with decreasing force *F* as defined in Table 5.

Table 5 — Test of characteristic and hysteresis at extreme temperatures for automatic variable load sensing devices

F [kN]	Type 1 - Nominal design pressure *Lcp_n* [bar]	Type 3 - Nominal design pressure *Lcp_n* [bar]	Measured pressure *Lcp_r* at + 70 °C [bar]	Measured pressure *Lcp_r* at - 25 °C [bar]	Measured pressure *Lcp_r* at - 40 °C [bar]
0	0	0			
10	0,8	1,0			
20	1,6	2,0			
30	2,4	3,0			
40	3,2	4,0			
50	4,0	5,0			
60	4,8	6,0			
50	4,0	5,0			
40	3,2	4,0			
30	2,4	3,0			
20	1,6	2,0			
10	0,8	1,0			
0	0	0			

6.2.7.5.2 Pass/fail criteria

At + 70 °C and at – 25 °C the difference between each measured pressure *Lcp_r* and the nominal pressure value *Lcp_n* shall not be greater than ± 0,2 bar in Table 5 for automatic variable load sensing device for interoperable applications.

At – 40 °C the difference between each measured pressure *Lcp_r* and the nominal pressure value *Lcp_n* shall not be greater than ± 0,3 bar in Table 5 for automatic variable load sensing device for interoperable applications.

If another type of device is to be tested the nominal characteristic values for that type instead of those in Table 5 shall be used but the same allowed differences apply.

6.2.8 Vibration and shock tests

6.2.8.1 Procedure

This test shall be made in accordance with the requirements contained in EN 61373:1999, Category 2.

6.2.8.2 Test sequence

The following tests shall be performed with a force of (10 ± 2) kN pre applied:

a) random vibration test in accordance with EN 61373:1999, Clause 8, with an input pressure of (5 ± 0,1) bar and with a pneumatic connection to the output signal pressure port;

b) functional tests 6.2.5 and 6.2.6 shall be performed after the vibration test;

c) simulated long life testing at increased random vibration levels in accordance with EN 61373:1999 Clause 9; with an input pressure of (5 ± 0,1) bar and with a pneumatic connection to the output signal pressure port;

d) functional tests 6.2.5 and 6.2.6 and shall be performed after the simulated long life test;

e) shock testing in accordance with EN 61373:1999, Clause 10. During the test the automatic variable load sensing device shall have an input pressure of (5 ± 0,1) bar.

6.2.8.3 Pass/fail criteria

Function and performance shall be within the defined limits.

The output pressure shall remain at its initial value ± 0,2 bar, throughout the duration of the shock test.

Visual appearance and mechanical integrity shall not change.

7 Routine tests (serial tests) and inspection

7.1 General

The following subclauses stipulate the routine inspection of the automatic variable load sensing device that shall be carried out on all devices following manufacture.

7.2 Check of characteristic

7.2.1 Procedure

Every automatic variable load sensing device shall, as a minimum, be subjected to the tests specified in 6.2.4.4.1 for at least the force (*F*) values: 20 kN (increasing), 40 kN (increasing) and 20 kN (decreasing) as indicated in Table 6 at an ambient temperature (preferred temperature (20 ± 5) C) and with an air quality in accordance with 4.5. The adjusting rate shall be between 10 kN/10 s and 10 kN/30 s without overshoot for both increasing and decreasing force.

It is acceptable for the tests to be conducted with a static force or a varying force with a peak-to-peak value of 15 % to 30 % of the nominal force at a frequency of 3 Hz.

The tests can be executed in a modified procedure and at an appropriate or specific test bench according to the requirements of a serial production.

Table 6 — Table for routine test of characteristic

F [kN]	Type 1 - Nominal pressure *Lcp_n* [bar]	Type 3 - Nominal pressure *Lcp_n* [bar]	Measured pressure *Lcp_r* [bar]	Direction of load change
20	1,6	2,0		increasing
40	3,2	4,0		increasing
20	1,6	2,0		decreasing

7.2.2 Pass/fail criteria

The difference between each measured pressure *Lcp_r* and the nominal pressure value *Lcp_n* shall not be greater than ± 0,1 bar.

8 Type validation

For automatic variable load sensing devices to be used on interoperable vehicles, an in-service trial may be required dependant on the verification requirements. Annex A contains typical test procedures for an in-service trial that can be used to assess an automatic variable load sensing device when fitted in a system having an interoperable distributor and relay device.

9 Documentation

The supplier shall make available documentation for supply to the purchaser, as may be required and agreed between the parties, to provide evidence of the design compliance and quality of the product, and give details of the device and its installation, operation and maintenance etc. Typical documentation should include the following:

— certification of conformity to design drawings and test/performance requirements;

— installation drawings to enable the device to be installed on a vehicle, these shall include all interface data required for connection to the vehicle or vehicle systems;

— part number and type designation together with applicable settings;

— technical description of the device describing its function and operation;

— recommended maintenance activities;

— safety related documentation e.g. handling and disposal instructions, health and safety data sheets.

10 Designation

Automatic variable load sensing devices complying with this European Standard shall be designated as follows:

a) number of this European Standard, i.e. EN 15625;

b) manufacturer (name or brand/logo);

c) manufacturers type designation;

d) part number.

11 Identification and marking

One or more durable identification plates (or indelible marking) giving the following information shall be permanently attached to (or permanently marked on) each automatic variable load sensing device:

— the manufacturer (name and/or brand/logo);

— the date of manufacturing (the week or month and year);

— the manufacturers type designation;

— part number;

— serial number;

— month and year of overhauling and the name (can be coded) of the overhauling company.

The identification shall be at the main body of the device preferably in a position that it can be seen when the device is installed on the vehicle.

Annex A
(informative)

Assessment of an automatic variable load sensing device when fitted to a vehicle

A.1 Vehicle assessment – Testing set up

This annex contains tests that can be conducted as part of the type examination certification of a new automatic variable load sensing device type and can be conducted to ensure the acceptable performance of the automatic variable load sensing device in terms of its effect on the vehicle air and brake systems and the ability of the device to withstand the vehicle environment.

A.2 Design acceptance testing set up

Tests related to the performance of the automatic variable load sensing device and its effect on the brake system and air system when fitted to a vehicle should be conducted as running tests within a train formation. This should ensure that the fitting of an automatic empty-loaded control mechanism does not affect the compliance of the compressed air brake system with the requirements of railway regulating bodies as applicable to the particular vehicle design.

A.3 Running tests

A.3.1 General

The purpose of these tests is to confirm that the correct functioning of the automatic variable load sensing device is not affected by random load variations occurring during running of a vehicle.

These tests should be carried out in both the empty and loaded condition of the vehicle.

If it is considered feasible/acceptable to conduct a running test simulation on a test bench then this may be conducted instead of the running test.

A.3.2 Pneumatic automatic variable load sensing device – Air consumption

A.3.2.1 Procedure

The test should use a loaded vehicle operating at 100 km/h (or the maximum speed of the vehicle) on a typical route with multiple curves and take place over at least one return trip. The vehicle should be equipped with a suitable means of monitoring the air usage of the automatic variable load sensing device. Isolate the vehicle brake and feed the brake auxiliary reservoir and automatic variable load sensing device via a check valve and choke of 0,7 mm from the brake pipe. Monitor and record the auxiliary reservoir pressure during normal running.

A.3.2.2 Pass/fail criteria

Any constant pressure drop throughout the duration of the test, greater than 0,2 bar below the pressure recorded in the auxiliary reservoir when the vehicle is static with the brake pipe in normal working (running) pressure, will indicate excessive air consumption.

A.3.3 Automatic variable load sensing device – Output signal variation

A.3.3.1 Procedure

The vehicle should be equipped with a suitable means of monitoring the output signal pressure of the pneumatic automatic variable load sensing device. During normal running check that shocks and vibrations do not unduly affect the output signal.

A.3.3.2 Pass/fail criteria

The output signal pressure (*Lcp*) should not vary by greater than ± 0,15 bar.

Annex ZA
(informative)

A1 Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community (Recast)

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 HS Rolling Stock, Table ZA.2 for CR Freight Wagons and Table ZA.3 for CR Locomotives and Passenger Rolling Stock, 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 HS TSI RST published in the OJEU dated 26 March 2008 and Directive 2008/57/EC

Clauses/sub-clauses of this European Standard	Chapter /§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard is applicable	4.Characteristics of the subsystem 4.2 Functional and technical specification of the subsystem 4.2.4 Braking §4.2.4.3 Brake system requirements §4.2.4.8 Brake requirements for rescue purposes §4.2.6.1 Environmental conditions, Environmental conditions §4.2.7.2.2 Measures to prevent fire	In 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 1.3 Health Clause 1.3.2 1.4 Environmental protection Clause 1.4.2 2 Requirements specific to each Subsystem 2.4 Rolling Stock 2.4.1 Safety §3 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3	

Table ZA.2 — 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

Clauses/sub-clauses of this European Standard	Chapter /§/annexes of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard is applicable.	4.Characterisation of the subsystem 4.2. Functional and technical specifications of the subsystem 4.2.4 Braking §4.2.4.1.2.2 Braking performance elements §4.2.4.1.2.7 Air supply §4.2.6 Environmental conditions 5 Interoperability constituents §5.3.3.12 List of constituents, Braking, Automatic load sensing & empty/load changeover device §5.4.3.13 Constituents performances and specifications, Braking, Automatic load sensing & empty/load changeover device 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, Specifications for assessment of the subsystem, Braking	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	The standard does not address the needs of Directive 2008/57/EC for Annex III, Essential Requirements: 2 Requirements specific to each Subsystem 2.6 Operation and Traffic Management – 2.6.1 Safety§2

	Annex I Braking, interfaces of interoperability constituents Annex P Braking performance, assessment of interoperability constituents Annex Q Assessment procedures, Interoperability Constituents Annex S Braking performance Annex FF Braking, List of approved brake components		

Table ZA.3 — Correspondence between this European Standard, the CR LOC and PASS RST TSI (final draft Rev 4.0 dated 24 November 2009) and Directive 2008/57/EC

Clauses/sub-clauses of this European Standard	Chapter /§of the TSI	Corresponding text, articles/§/annexes of the Directive 2008/57/EC	Comments
The whole standard is applicable.	4.Characterisation of the rolling stock subsystem 4.2 Functional and technical specification of the subsystem 4.2.4 Braking §4.2.4.3 Type of brake system §4.2.4.4 Brake command §4.2.4.5 Braking performance §4.2.4.10 Brake requirements for rescue purposes §4.2.6.1 Environmental conditions, Environmental conditions §4.2.10.2 Fire safety and evacuation, Material requirements	Annex III, Essential requirements 1 General requirements 1.1 Safety Clauses 1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5 1.2 Reliability and availability 1.3 Health Clauses 1.3.2 1.4 Environmental protection Clause 1.4.2 1.5 Technical compatibility 2 Requirements specific to each subsystem 2.4 Rolling stock 2.4.2 Reliability and availability 2.4.3 Technical compatibility §3	The full compliance with the TSI requirements depends on the way the product is integrated into the rolling stock.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard. 〈A1〉

〖A1〉 *deleted text* 〈A1〗

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[1] UIC 540, *Brakes — Air Brakes for freight trains and passenger trains*

[2] UIC 541-1, *Brakes — Regulations concerning the design of brake components*

[3] UIC 541-04, *Brakes — Regulations concerning the manufacture of brake components — Self-adjusting load-proportional braking system and automatic 'empty-loaded' control device*

[4] UIC 543, *Brakes — Regulations governing the equipment of trailing stock*

[5] UIC 547, *Brakes — Air brake — Standard programme of tests*

[6] ISO 2533, *Standard Atmosphere*

[7] DIN 1343, *Referenzzustand, Normzustand, Normvolumen — Begriffe und Werte*

[8] EN ISO 228-2, *Pipe threads where pressure-tight joints are not made on the threads — Part 2: Verification by means of limit gauges (ISO 228-2:1987)*

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