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RnV-Standard M-001

Railway Safety
Admission Requirements
Rolling Stock

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Colophon

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The quality system operated by Railned Spoorwegveiligheid is certified according to the ***NEN-EN-ISO 9001:1994*** *standard, under DNV number CERT-00880-98-AQ-ROT-RvA*

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Contents

1. GENERAL

This standard has been issued by the Head of Railned Spoorwegveiligheid (Railned Railway Safety).

1.1 Verification and authorisation

By initialling the block below, the **Standards Manager** confirms that this standard has been prepared according to the requirements of the quality system of Railned Spoorwegveiligheid.
By placing his initials in the block below, the **Head of Railway Safety** approves the issue of this standard.

	Position and name	Date	Initials
Verification	Standards Manager: J.P.J.M. van den Hout		
Authorisation	Head of Railway Safety: W.A Vriesendorp		

1.2 Purpose and function

- This standard lays down the requirements imposed on rolling stock, to permit the safe use thereof on the national railway network in the Netherlands.
- The standard also has a function in the admission procedure for rolling stock.
- Rolling stock submitted for admission will be assessed according to this standard (for the admission procedure, see RnV-Standard M-005).

1.3 Area of application/operating area

This standard applies to all rail vehicles used by railway companies on the basis of an access agreement to the national rail infrastructure. Rail vehicles shall be taken to mean rolling stock, including all tractive units, passenger coaches, freight wagons and special rail-specific vehicles such as maintenance machines for maintaining the infrastructure.
For special deployment and/or limited routes and/or limited periods, for each admission application, an investigation will have to be carried out as to which sections of this standard are applicable (fitness for use). This latter stipulation applies specifically for incidental transport, maintenance machines and recreational stock collections.

1.4 Higher regulations

This is a standard as intended in the RRV.
This standard is a further elaboration of the stipulations in RRV, chapter IV (Stock).
RDHL Regulations for Services on Main and Local Railways.

1.5 Implementation

In application of this standard and the other standards and documents mentioned therein (such as UIC leaflets, ERRI reports, STI HSL, DIN, EN, CEN, CENELEC, RIV, RIC, RID), verification must be obtained that the last applicable version has been employed. The version number of this standard appears on the front page and in the foot text of this standard. By employing experience accrued in the material admission process, and through the development of European regulations, this standard will be frequently updated. This means that instead of the above mentioned standard and documents, not the latest version, but the replacement issues or standards will apply.
However, it does not automatically follow that as soon as the standard is altered, all submitted stock should be adapted. In that connection, separate, explicit rules may apply.

The last applicable version is listed in the standards register, available from Railned Spoorwegveiligheid.
This standard will be effective from 20 June 1998 (Dutch version).

1.6 Exemptions and other decisions

Exemptions to this standard may only be issued by the Head of Railway Safety.
On matters not clearly determined by this standard, the Head of Railway Safety will decide.

1.7 Distribution

An original copy (Dutch version) of this standard will be automatically issued to the management and the railway safety expert of:
Railned
Railway companies
NS Railinfrabeheer
NS Materieel

Distribution of copies of this RnV standard, within the above mentioned organisations, must be carried out in a controlled manner, by and at the responsibility of the relevant management.
The distribution of copies to clients of these organisations must be carried out in a controlled manner, by and at the responsibility of the management of the issuing party.
The distribution of copies to the management of organisations not mentioned hereinabove will be carried out following requests made to the standards manager (see front page).
The English version will be issued only on request.

2. OVERVIEW OF STANDARDS

In the following section, for each area of attention, standards (UIC leaflets, DIN, EN, etc.) are listed, which describe the previously mentioned state of development. In the column documents , those documents are listed which under all circumstances will be relevant to the initial type assessment of a new stock unit, in some form or another. Those sections of the UIC leaflets listed in the relevant leaflet as compulsory will apply.

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon	Comments
A, Electrical installation				
1	Insulation coordination		prEN 50124 -	
2	Pantograph	- type admission report - type test report	-	See 3.7
3	Interference currents	- description	-	See 3.5
4	EMC 1.5 kV 25 kV		ENV 50121-3 -	
5	Return currents	- description	UIC 512 -	See also 3.10
6	Safety earthing	- description - drawing	UIC 533, 552 UIC 533	See also 3.10
7	Electrical power supply		UIC 550 -	
8	Touching safety	- description - drawing/protocol	UIC 617, 533, 552, 611 prEN 50153 -	See also 3.11
9	Battery		-	Short-circuit protection close to battery
10	Depot supply		-	
11	Fire regulations	Submit details of fire-retardant characteristics.	UIC 642, 564 All materials used must have fire-retardant characteristics. -	Document: BPRM Mw3R/094/ 52/5
12	Communication	- type admission report - admission HDTP	UIC 750, 751 -	B-Regulations Part X (C5504/X) See also 3.13
13	Miscellaneous		UIC 648 -	

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
B, Body shell and bogies							
1	Freight wagons:						
	Bogies, frames, End walls, Sliding walls, boilers, etc.	- type admission report - conformity report - overview drawing - measuring protocols - static and dynamic strength report, calculation and testing.				UIC 510, 577, 573, 576	Also applicable: VSG-RID, Stoomwezen rules for pressurised vessels, ERRI B12/RP17 See also: 3.6
2	Passenger stock:						
	Bogies, handles, transfer devices, body shell, etc.	- type admission report - conformity report - overview drawing - measuring protocols - static and dynamic strength report, calculation and testing.		UIC 515, 615, 560, 561, 566, 617			
3	Locomotives and other vehicles:						
	Bogies, body shell, etc..	- type admission report - conformity report - overview drawing - measuring protocols - static and dynamic strength report, calculation and testing	UIC 615, 617, 577				Also applicable for special vehicles

No.	Contents	Documents	Standards for each stock type				Comments
			loc.	m.u.	coach	wagon	
C, Running gear							
1	General and strength	- calculation report - type admission report	UIC 505, 506, 518, 521, 610	UIC 505, 506, 518, 521, 560, 610	UIC 505, 506, 515, 518, 521, 560	UIC 505, 506, 518, 521, 530	also applicable: ERRI B55/RP8 C138 RP9 see also 3.6
2	Components, bogies, wheel sets, axle bearing, suspension, etc.	- drawing	UIC 812-3 615	UIC 812-3 615	UIC 515, 812-3	UIC 812-3 510, 511, 517	also applicable: ERRI B136/RP11
3	Wheel diameters	- drawing	UIC 510-2, For wheel diameters smaller than 840 mm, advice from RIB is necessary				
4	Speed		-	-	-	UIC 432	
5	Calculations	- calculation report	-	-	-	ORE/ ERRI ----->	also applicable: B12 DT 135
6	Protective shields/ Guard irons	- drawing	Distance: 100 mm above rail on empty stock		-	-	Front bogies, also for driving trailers

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
D, Interior							
1	General fire safety	Submit data on fire-retardant characteristics.	UIC 564, 642 DIN 5510 All materials used must have fire-retardant characteristics.			-	Document: BPRM Mw3R/094/ 52/4
2	Emergency lighting	- drawing - description	-	UIC 555		-	
3	Cab front window		UIC 651, 617-4 ISO 3538 DIN 52305, 52335, 52336			-	
4	Colour point shift		UIC 651			-	
5	Lines of sight, driver	- drawing	UIC 651			-	
6	Emergency escape windows and emergency exits	- number - description - drawing	UIC 651	UIC 560, 564-1, 651		-	
7	Safety glass		UIC 564-1 DIN 1249-12			-	
8	Furnishings		-	UIC 566 ERRI B106-2		-	
9	Markings		-	UIC 580		-	

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon	Comments
E, Brake system				
1	General	- brake calculation - type test report	UIC 540, 541, 542, 543, 544, 545, 547, 640, 648	
2	Components		UIC 541, 542	
3	High capacity brake	- brake calculation - type test report	UIC 546 -	For high-speed trains: ERRI B126/7 and STI HSL apply

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
F, Door system							
1	General	- description - drawings	-	UIC 560, 565, 568		-	RnV standard: M-003
2	Components		-	UIC 564, 625 prEN 50155		-	

No.	Contents	Documents	Standards for each stock type				Comments
			loc.	m.u.	coach	wagon	
G, Freight wagons							
1	Markings					UIC 438-2	
2	Design	- type admission report - conformity report - overview drawing - measuring protocols				UIC 432, 505, 527, 533, 571-3,4 581	Also applicable: RIV chapter VII RIV app. 4 RIV art. 34
3	Built-on components					UIC 532, 535, 543, 575	
4	Superstructure					UIC 573, 576	Also applicable: VSG-RID Stoomwezen rules for pressurised vessels
5	Special wagons	- type admission report - conformity report - overview drawing - measuring protocols				UIC 512, 549	Also applicable: RIV art. 32.2 RIV chapter VII RIV app. 4 + 5
6	Strength	- static and dynamic strength report, calculation and testing				UIC 577 ERRI: B12 RP17	Also applicable: VSG-RID Stoomwezen rules for pressurised vessels
7	Containers and exchange wagons	- type admission report					UIC 590, 591, 592-1-2-4, 593, 596-5-6 VSG-RID-RIV NEN 283-284

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
H, Additional systems							
1	Black box registration	- description - read out procedure	RnV standard M-002		-	-	also for driving trailers
2	Automatic train control ATP/ATC	- certificate of safety - certificate of safe implementation	See CENELEC 50126 .. 50129		-	-	also for driving trailers
3	Automatic vigilance device	- description - type admission report	UIC 641, operating at all speeds		-	-	Also for driving trailers
4	Front signals and rear signals		UIC 534, 651; also applicable for driving trailers		UIC 532		Signal book
5	Radio control	- type admission report	See 2.4	-	-	-	
6	Interference current detection	- type admission report	See 2.5				
7	Horn, warning devices		UIC 644				also for driving trailers
8	Characteristics necessary to operate Track-circuits	- type admission report	UIC 512				See 3.2

No.	Contents	Documents	Standards for each stock type loc.	m.u.	coach	wagon	Comments
I, Buffing and draw gear							
1	Automatic coupling	- description - type admission report	See 2.6		-	UIC 522, 523, 524	For driving trailers see 3.6
2	Buffers / draw gear		UIC 521		UIC 520, 521, 527, 528	UIC 520, 521, 526, 527	
3	Screw coupling				UIC 520		
4	Coupling hook				UIC 520		
5	Calculations	- calculation report	-	-	-	ERRI ---->	Also applicable: B36 RP32 B12 RP17 B12 DT135

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
J, Main dimensions and design							
1	Pressure impulse on platform		See 2.9				
2	Wind load	Report: investigate derailing sensitivity of HST front coachs under suddenly occurring powerful side winds.		See 2.9			Also for HST driving trailers See 3.9
3	Vehicle gauge, loading gauge		UIC 505, 506 RnV standard: I-002 RIB assessment if outside GA, for local limitations				
4	Visibility of train fronts	Investigation report	Rule: track workers must have at least 30 sec. to clear the track, before the train arrives.				Also applicable for driving trailers

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
K, Inventory							
1	Red flag		in cab		-	-	also for driving trailers
2	Emergency signal lamp		in cab		-	-	also for driving trailers
3	Short-circuit cable		in cab		-	-	also for driving trailers
4	Fire extinguisher		in cab		in coach	-	also for driving trailers
5	First Aid kit, covering film and gloves		cab or conductor s area			-	also for driving trailers
6	Auxiliary coupling		-	on AC	-	-	For coupling with buffer stock

No.	Contents	Documents	Standards for each stock type loc. m.u. coach wagon				Comments
L, Electronics and software applications							
1	General	- type admission report - safety certificate - certificate of safe implementation	CENELEC 50126, 50128, 50129, 50155			-	also for driving trailers

3. Supplementary specific requirements

Introduction
For each chapter, a category (A, B or C) is indicated:

Category A:
Requirements based on specific Dutch infrastructure characteristics, of compulsory character to permit safe movement.
Category B:
Requirements based on specific Dutch systems which as such are not a requirement for safe movements, but which are required by law, or are indispensable for normal participation in rail traffic.
Category C:
Specific Dutch requirements based on Dutch risk assessments which as such are not necessary for participation in rail traffic, but which in the event of non-compliance will impose limits in respect of normal, regular participation in rail traffic.

3.1 Body construction (Cat. C)

Safety requirements in respect of the strength of the body construction, passive crash safety and protective shield:

Introduction
The basis for admitting stock in respect of the crash philosophy is the safety of passengers and personnel. Safety is broken down into active safety, the prevention of collisions, and passive safety, the limiting of damage in the event of a collision. Clearly, active safety is the most effective. The railways therefore also spend far and away the greatest proportion of care on these matters. Because practice has shown that it is not possible to prevent collisions 100%, passive crash safety makes a contribution to increasing the safety of the passengers and personnel, in the event of a collision.

Description of terms
Protective shield:
A protective shield is a structure mounted in front of the first bogie of a train formation, and its purpose is to reduce the risk of derailment in the event of a collision with objects, in particular at level crossings. A protective shield itself may never lead to increased risk of derailment, for example if torn off.
Passive crash safety:
Passive crash safety is taken to mean protection provided by the rolling stock to the passengers, the personnel and the load, at the moment at which a collision occurs. The body construction plays an important role.
Deformation behaviour of the body construction
The deformation behaviour of a body construction describes the way in which a body construction deforms, over time, in the event of a specific crash situation.
Light Rail rolling stock:
Over the next few paragraphs, Light Rail rolling stock is defined as rolling stock which does not comply with all crash-safety requirements. For this rolling stock, compensatory measures are necessary, to allow admission.

Requirements in respect of the protective shield
The following admission requirement has been formulated for new passenger rolling stock still to be admitted:
A protective shield must be placed in front of the first bogie of the train formation, in order to reduce the risk of derailing following collision with an object on the track. The protective shield may under no circumstances increase the risk of derailment.
The protective shield must operate at the maximum speed of the rolling stock, for the following scenarios:

- Collision on a crossing with a mass of 500 kg (centre of gravity 350 mm above the track);
- Collision on the track, with cattle with a mass of 1200 kg.

The applicant must demonstrate that the protective shield employed will function under the above described circumstances. With this in mind, the applicant must submit calculation reports and possibly test reports.
Based on practical experience within the Netherlands and results of research carried out by Railned Spoorwegveiligheid, the following rule has been prepared, for the compulsory mounting of a protective shield:

- At a maximum rolling stock speed of less than or equal to 140 km/h, and an axle load of less than or equal to 13,000 kg;
- At a maximum rolling stock speed in excess of 140 km/h and an axle load of less than or equal to 17,000 kg.

If the construction of the rolling stock is demonstrably non-susceptible to derailment upon collision with objects, in particular at level crossings, no protective shield need be fitted.

The following specific requirement applies for new Light Rail rolling stock to be admitted:
The applicant must demonstrate whether it is possible to install a protective shield, which complies with the above formulated requirements.

Requirements in respect of crash safety
Developments in admission requirements for crash safety:
At present, on an international level, work is being carried out on drawing up specific requirements in respect of crash safety, and the way in which these matters must be made demonstrable, by formulating STI s (Spécification Technique Interoperabilité). As soon as the STI s are introduced, they will replace the admission requirements described here, for HST rolling stock.
Although the STI relating to crash safety is not yet definitively determined, according to the current state of development, it is expected that the admission requirements will match the admission requirements described below, supplemented by a collision at a crossing between a train travelling at a speed of 110 km/h and a rigid mass of 15 tonnes.
However, until the STI s for high-speed rolling stock are implemented, for the admission requirements in respect of crash safety, there is no difference between high-speed rolling stock and normal passenger rolling stock (Heavy Rail).
Requirements in respect of crash safety:
In addition to the UIC leaflets listed in chapter 2, the requirements in respect of crash safety with which the body construction must comply are as follows:

- The superstructure must be capable of withstanding a frontal collision with other rolling stock up to a speed of 36 km/h, whereby the passenger and personnel compartments experience no deformation. The other rolling stock may be fitted with either automatic coupling or buffers (locomotive, freight wagons).
- The applicant must demonstrate that the deformation behaviour of the body construction complies with this requirement. With this in mind, the applicant must submit calculation reports and possibly test reports.

In general, it may be stated that: all parts of the body shell and the attachment of parts to the body shell must be designed in such a way that they can withstand linear acceleration of 3 g.
For special vehicles, which are not pushed off, a minimum body construction capacity applies of:

- 1200 kN in the event of symmetrical buffer load;
- 400 kN in the event of diagonal buffer load;
- 1000 kN drawing load.

The following specific requirement applies for new Light Rail rolling stock to be admitted: The applicant must analyse the deformation behaviour of the body construction, in the collision described above. This analysis must be backed up by calculation reports. For Light Rail applications, any lower body strength must be compensated for by some other system or provisions.

3.2 Train detection, operating track-circuits (Cat. A)

Diesel stock with good running characteristics detects below standard. Light Rail and various rail-specific maintenance machines detect insufficiently. At present, admission can only be awarded, following the extensive testing of the detection characteristics, or solely for use on sections of track with a special detection function (e.g. second detection layer, axle counters, measures for level-crossings).

Selection model (Standard RIB TS) is expected to be available in July 1998.

Position at 24-04-1998:

RIB TS is formulating the cases in which further detection investigation must be carried out (combination of axle loads, traction type, running characteristics, etc.). Results are expected in 1998.

The most common measuring method will be documented. This method could perhaps undergo further development (in particular in respect of reproducibility).

Train detection on special vehicles (according to CEN/TC 256/SC 1/WG 5 N 61 D January 1996):

- minimum axle load 4500 kg;
- maximum distance between two consecutive axles is 22 m (note: UIC 512 prescribes 17.5 metres);
- electrical resistance between wheels on one axle is less than 0.01 Ω for new built units and after re-binding, and less than 0.1 Ω during the life time of the wheel set, and following reprofiling;
- if specified by the infrastructure manager or Railned Spoorwegveiligheid, an approved detection assistor;
- if tread brakes are not employed, a facility is necessary for keeping the running surfaces of the wheels clean.

3.3 Automatic train control and speed measurement (Cat. B)

Temporary stipulation:
Automatic Train Control must be present in all locomotives, trains and driving trailers. The admitted ATB train equipment for first-generation ATB tracks is type PHASE 3 and type PHASE 4, and for ATB new-generation track, type ATBNG. Manufacturer: GEC Alstom ACEC (based in Charleroi Belgium) or equivalent.

3.4 Radio locomotive control (Cat. C)

Introduction
Radio locomotive control is taken to mean the wireless or remote control of a locomotive with a locomotive radio control system, consisting of a transmitter and a corresponding receiver. It is an added locomotive function.
Radio control is carried out by a radio locomotive driver, who is located in or close to the locomotive, with the transmitter.

Minimum functions
This section describes the minimum requirements and functions for admission of radio locomotive control, on the Dutch railway network.

Emergency stop
If an unsafe situation occurs within the process of radio locomotive control, the radio locomotive driver must have a facility for halting the locomotive as rapidly as possible. A control system, for example an emergency stop, should be fitted on the transmitter for this purpose, which in emergency situations can immediately generate an emergency stop. Operation of this function should lead to the shutdown of traction, and full braking of the train, within 0.5 seconds.
If the emergency stop function fails, this should always result in the shutdown of traction, and immediate full braking of the train.

AVD Automatic Vigilance Device
In radio locomotive control, an automatic monitoring system, also known as the AVD should be fitted, which monitors the availability of the duty radio locomotive driver.
The AVD should immediately be switched on once the direction (driving forwards or backwards) has been selected. If direction has been selected, and within a period of more than 60 seconds, no command is generated by the radio locomotive driver, an audio signal should be activated in the transmitter, for a period of 2.5 seconds. If during these 2.5 seconds, the radio locomotive driver generates no command, within 0.5 seconds this should result in the shutdown of traction and full braking of the train.
If the AVD function fails, this should always result in the shutdown of traction, and the immediate full braking of the train.

Command should be taken to mean the operation of one of the operating elements and/or an attention button. The continuous issuing, or the unintentional generation of a command may not result in the suspension of the 60 second cycle.

Contact monitoring
Radio interference or loss of radio contact between transmitter and receiver during radio controlled locomotive operation should result in the shutdown of traction and full braking of the train, within 0.5 seconds.
If the contact monitoring function fails, this should always result in a shutdown of traction and immediate full braking of the train.

Identification/recognisability
The identification and recognisability of a radio locomotive control system and the corresponding locomotive must be established on a technical and/or procedural basis. In this connection, a receiver should respond solely to its corresponding or allocated transmitter.

Tilting protection
In the transmitter, a protection device must be fitted which ensures that the locomotive is halted, if direction of traffic has been selected and the radio locomotive driver falls, and is unable to stand back up, for example as a result of injury. However, the protection system should not limit the radio locomotive driver in his freedom of movement, for example the ability to walk under a buffer.
At the moment that a direction of traffic has been selected on the transmitter, and the transmitter is placed at an angle of 45° for longer than 5 seconds, besides normal carrying position, an acoustic signal should be activated within the transmitter, for a period of 2.5 seconds. If during these 2.5 seconds, the transmitter is not returned to the normal position, within 0.5 seconds, this should result in the shutdown of traction, and the full braking of the train.

Acoustic signal
The transmitter must be equipped with a facility to activate the horn fitted in the locomotive, in order to issue an acoustic signal. The generation of a horn command should result in the required function in the locomotive, within 0.5 seconds.

Construction

Operability
All control elements must be easily reachable and easily operated, whereby it should be possible for the operator to wear stiff gloves.

prEN standards
A radio locomotive control system must at least comply with the requirements laid down in the following standards:

prEN 50121-3 : Railway applications, Electromagnetic compatibility aspects of Railways.
EN 50155 : Railway applications, Electronic equipment
prEN 60215 : Safety requirements for Radio-transmitting equipment

As concerns radio communication, the radio locomotive control system must be approved by the HDTP (Hoofddirectie Telegrafie en Posterijen Central Directorate for Telegraphy and Postal Services).

Approval documents
This section describes the minimum documents required for approval and admission of a radio locomotive control system.

Specific approval document for radio locomotive control systems
The carrier must be able to demonstrate, in the form of a document, that the radio locomotive control system submitted at least complies with the functions described and specified in the above section.

Other documents
Other documents should be taken to mean approval documents as generally required for the admission of a control system for radio locomotives, including:
- Certificate of admission from the HDTP, in connection with radio communication systems;
- Test reports;
- Operators manual.

3.5 Interference current detectors and interference currents (Cat. A)

3.5.1 Interference currents

acknowledgements:

IEC 801 (prEN 61.000-4-..)	measuring instruments/ control equipment
prEN 50.081	general immunity standard
prEN 50.082 part 1 and 2	general emission standard
prEN 50.121-3	Railway applications - Electromagnetic compatibility

Introduction
These safety requirements apply to interference currents on all rolling stock.

Definitions
- Automatic train control interference current: The effective value of the current achieved by filtering the AC current component of the return current, using a band low-pass filter, with a filter characteristic as shown in appendix 1.

- Protection interference current: The effective value of the current achieved by filtering the AC current component of the return current, using a band low-pass filter, with a filter characteristic as shown in appendix 2.
- Train impedance: The 75 Hz impedance of a train, as observed between the contact wire and the rails.
- Electromagnetic compatibility: E.M.C. is the possibility of ensuring that equipment functions satisfactorily in its electromagnetic environment, without introducing intolerable interference in that environment, or to other equipment.
- Electromagnetic interference: E.M.I. is an electromagnetic interference which presents itself in the form of reduced performance, interruption or failure of electrical or electronic equipment.
- The psophometric values of the traction return current are calculated by determining the effective value of the filtered traction return current according to the filter curve in appendix 3 (according to CCITT 1960).

Maximum value
- The effective value of the automatic train control interference current must be ≤ 500 mA per train.
- The effective value of the protection interference current must be ≤ 500 mA per train.

Minimum value train impedance
The 75 Hz impedance, under all operating conditions, must be greater than the value listed in appendix 4, as a function of the indicated phase value.

Psophometric values of the traction return current
The psophometric value caused by the traction return current may not exceed 10 A for a complete train formation.

AC component
The effective value of the total AC component in the traction return current may not exceed 50 A, on a complete train formation.

General emission standard
The electrical installations should be constructed in such a way that they have no effect or influence on other installations (prEN 50.081-1 / prEN 50.121-3).

General immunity standard
The electrical installations should be produced in such a way that they cannot be influenced by the effects of other installations. (prEN 50.082-1 / prEN 50.121-3).

3.5.2 Interference current detectors

Introduction
Interference currents in the rails and in the catenary can for example negatively influence the block safety system and the automatic train control system. In order to limit the risks caused by interference currents (actively) caused by rolling stock, rolling stock must be equipped with a so-called interference current detector, unless it can be demonstrated that an interference current detector is unnecessary, for the application in question. If a specified threshold is exceeded, this detector issues a shutdown command, to shut down the system(s) causing the interference current.
This section contains the standards with which the interference current detector must comply. The standard is used as a basis for admission criteria.
The first section deals with the Detection functions . Requirements in respect of design are listed in the section Design . A number of admission documents (the minimum number required) are described in the final section (Admission documents).

Detection functions

If the effective value of the line current in a specified frequency area taken up by a train is exceeded, the unit causing this value to be exceeded must be shut down, with a view to reducing interference currents in the network and in the track.
The line current is defined as the current passing through the current collector. In the event that more than one current collector is fitted on each train set, the sum of the currents applies. In other words: the line current is the total current running from the catenary through the train set to the track.
One or more interference current detectors are installed in each train set. In order, even in the case of coupled train sets, to achieve an acceptable compromise between the number of shutdowns on the one hand, and the risk as a result of possibly excessive interference current on the other, the threshold limit and the length of the period of violation should be adjustable.

Frequency range

The detector should measure the line current, according to the following frequency characteristic:
- Up to tilting point at 68 Hz ± 1 Hz: increasing by 96 dB/oct ± 3 dB/oct.
- 68 Hz to 82 Hz range: flat (± 0.5 dB).
- After tilting point at 82 Hz ± 1 Hz: decreasing by 120 dB/oct ± 3 dB/oct.

Threshold value

If the effective value of the line current (in the described frequency area) exceeds a specified threshold, the detector should generate a shutdown command. The line current should be measured, with a maximum inaccuracy of 1% of the specified maximum threshold setting value.
This threshold should be adjustable in fixed stages. The range and stage size are both dependent on the rolling stock, but should be such that the threshold value can be set according to the following criteria:
- The risk of influencing the condition of the track relay by interference currents is acceptably small (for safety reasons).
- The risk of negative influence from interference currents on the correct transfer of ATB signals is acceptably small (for safety reasons).
- The risk of the blocking of train functions is acceptably small (availability).

Duration

The detector may only generate a shutdown command if the threshold value is exceeded for a specified continuous period.
This period must be adjustable in fixed stages. The range and stage size will both be dependent on the rolling stock, but should be such that the threshold value can be adjusted according to the following criteria:
- The risk of influencing the condition of the track relay by interference currents is acceptably small (for safety reasons).
- The risk of negative influence from interference currents on the correct transfer of ATB signals is acceptably small (for safety reasons).
- The risk of the blocking of train functions is acceptably small (availability).

Shutdown command

The shutdown command will be issued as long as the interference current level is exceeded. The minimum period of the shutdown command will depend on the rolling stock.

Bridging

Normally speaking, the interference current detector should be active (operating) when equipment is switched on which could cause interference currents, as a result of a fault. In the event of a fault in the detector itself, the shutdown command should be lockable/bridgeable.

Bridging should be a very conscious action, and should therefore only be possible, for example, following the breaking of a seal.

Other functional conditions
- The total reaction time of the detector (time delay as a result of filtering and effective value determination), may not exceed 500 ms.
- The detector should be less sensitive to interference currents from the catenary, by a factor of 10, than to interference currents from the train set within which the detector is located.

Design

Location, access
For each train set, one or more interference current detectors may be fitted, depending on the rolling stock type. The bridging switch should be easily accessible for the driver.

Standard EN 50155
The interference current detector must comply with the requirements of standard EN 50155. This standard applies for general electronic equipment, installed in rolling stock.

Admission documents

The admission documents described below are the *minimum* requirements for admission of an interference current detector.

Specific admission document for interference current detectors
This document relates to the functioning of the interference current detector. It must at least demonstrate that the detector complies with the functions specified in the section Detection functions . The following should be covered:
- The overall operation of the detector;
- The sensitivity of the detector as a function of frequency;
- The accuracy of the line current measurement;
- The setting range and stage size of the threshold value;
- The setting range and stage size of the duration.

Other documents
These include admission documents such as those generally required for the admission of equipment in the train, including:
- Test reports;
- Operating manual.

The documents must at least demonstrate that the detector complies with the requirements specified in the section Design .

3.6 Automatic coupling and curve running

3.6.1 Automatic coupling (Cat. C)

This section also applies to all other types of coupling such as short couplings, for internal train sets, shunting couplings, towing couplings, etc.
The automatic coupling must offer a breaking strength of at least 1 MN.
The automatic coupling should be capable of permitting all movements of the body during curve running and point switch running, whereby any reaction forces should be minimal.

The supplier of the body should be able to demonstrate these matters, according to a free-running calculation.
In addition, the supplier must be able to demonstrate the static and dynamic strength of this component, in the form of calculations.
According to a calculation, the supplier must be able to demonstrate that the automatic coupling is sufficiently dimensioned in respect of energy absorption during coupling at maximum coupling speed.
The automatic coupling should not increase the risk of derailment during a collision with cattle on the open track, or with vehicles at level crossings, for example by bending or tearing off.

3.6.2 Curve running (Cat. A)

In curve running by two coupled vehicles, during the passage of a curve of 150 metres, the lateral forces occurring may never exceed 250 kN. This should be demonstrated according to a curve running calculation according to ERRI B36/RP32.
In order to monitor the maximum tension occurring, the minimum radius of curvature which is run, coupled, must be taken as the point of departure, where the initial tension matches the coupling situation in service, e.g. freight wagons in braked position G, uncoupled, and the brake position P, tightly coupled, whereby tightly coupled with a screw coupler matches a maximum initial tension of 12 mm on straight track.

3.7 Catenary voltage / Power supply voltage / Current collectors (Cat. B)

Acknowledgement:

IEC 99 sections 1 and 2	recommendations for lighting protection
EN 50.163	power supply voltages for traction Installations
	Specifications for various rolling stock.

During normal operation, catenary voltage can be between a minimum value of 1000 V and a maximum value of 1950 Vdc. A nominal voltage of 1500 V is assumed (EN 50.163).

At present, the maximum current to be consumed is 4000 A (Ampere) at 1500 V per train or train formation.

Investigations are currently underway as to whether it is feasible to travel with 5000 A (Ampere) per train or train formation on a number of sections of track.

In the future, it will be possible to travel on sections of track with a voltage of 25 kV. The 25 kV network option is still being studied.
The catenary voltage has a nominal value of 25 kV at 50 Hz.
The network will be developed according to the CENELEC/UIC specifications (EN 50.163)

When consuming power supply voltage, the rolling stock must comply with the following points:

- The irregularities which may occur in the catenary, such as regular interruptions at section dividers, voltage-free bridges and supply disruptions should have no negative consequences for the rolling stock, and vice versa. Refer also to current collectors.
- The installation of an overvoltage installation is recommended, in order to discharge excessive voltages, for example lightning strikes, without the rolling stock becoming damaged (IEC 99).

- The maximum recuperation current to be fed back is 4000 A.
  The maximum catenary voltage is 1850 V, on recuperation. If the value of the catenary voltage falls below 1200 V, recuperation is no longer permitted.
- The electrical installation in the rolling stock must be able to withstand voltage jumps equal to or smaller than 300 V, without (temporarily) shutting down (appendix 5 replaces figure 6 from IEC 411-4).
  Voltage jumps exceeding 300 V, within the voltage range between at least 1000 V and at most 1950 V should not damage the installation.
  The rolling stock should be equipped with an overvoltage protection system which protects the underlying installation.
  The rolling stock should be fitted with an installation (such as a high-voltage switch/rapid-action circuit breaker) which at all times can shut down the running current, within the specified time, so that the underlying installation is not damaged. It must be possible to call on this system several times. Refer also to the guidelines for the rapid-action circuit breaker.
- The return current circuit on the rolling stock must be able to handle return currents with a value of 4000 A. The rolling stock must be resistant to short-circuit currents from the substation. Refer also the directives for the return currents/safety earth.
  In the event of mains power failure, it is desirable that the current collector be lowered and kept in this lowered position for approximately 1 minute.

Current collectors:

Acknowledgement: construction directives and specifications.

Introduction

This safety requirement applies to current collectors suitable for:

- Traction Energy Supply with a nominal voltage of 1500 Vdc, for speeds up to 160 km/h.
- Traction Energy Supply with a nominal voltage of 25 kV, 50 Hz, for speeds up to 200 km/h.

Functional requirements 1500 Vdc / 25 kVac

- The current collector should guarantee practically sparkless current transfer, under all circumstances on the NS network.
- The current collector must be able to function correctly at a catenary height of between 4.80 m + top of rail and 5.75 m + top of rail.
- The current collector must be fitted with a height limiter. The height limiter must be set at 5.86 m + top of rail, nominal
- The static approach force must be adjustable across a sufficient range (80 - 160 N for the national 1500 Vdc network). The aerodynamic component in the approach force must be as low as possible, across the entire speed range. The maximum will depend on the maximum train formation, and the number of current collectors.

Installation on the roof

- The insulators must comply with the requirements of standard prEN 50.124 in respect of creep paths and air passages, in the event of serious soiling by conductive dust.
- The air hose (1500 V): the insulation resistance, measured between the plugs and clamping strips or metal connectors, may not be less than 500 Mega ohm (MΩ measured at a DC voltage of 500 Volt).
  If the air hose and/or cable is longer than 30 cm, or if the cable or hose is subject to mechanical loading through vibrations and shocks, the hose/cable should be supported with an insulator.
- For mixed operation (1500 Vdc / 25 kVac), the roof installation should be insulated for 25 kV.

Horned slipper holder

- The maximum loading gauge of the horned slipper holder should comply with UIC leaflet 57H2 or appendix 4 of UIC leaflet 608 for 25 kV (High-Speed lines). For the maximum loading gauge for the 1500 V network, appendix 4 of UIC leaflet 608 applies.

Safety and maintenance

- The current collector should be blocked in an earthed condition; this can for example be achieved in the constructional earthing/key procedure.

Testing

- The current collector must comply with the type test as described in the IEC 494 / prEN 50.206 standard.

Technical requirements: (1500 Vdc / 4 kA traction energy supply systems)

No.	Aspect	Technical requirements	Standards
1 Catenary voltage			
1.1	Voltage range	U_{min2} = ??? V for max. 10 min. U_{min1} = 1000 V unlimited U_{max1} = 1800 V unlimited U_{max2} = 1950 V for max. 5 min.	EN 50163
1.2	Overvoltages	U_{max3} = 2538 V t = 20 ms U = ??? t < 20 ms	EN 50163
1.3	Ripple	$U_{top\text{-}top} \leq 274$ V	
1.4	Voltage jumps	Within the range listed sub 1.1	
2 Current			
2.1	Current collection, running	I ≤ 4000 A per train	
2.2	Current collection, stationary	$T_{contact\ wire} \leq 80$ °C and I ≤ 4000 A per train	
2.3	Recuperation current	I ≤ 4000 A per train	
2.4	Current limits	I = 0 A at U < 950 V (preference for gradual current limit with bottom limit 950 V and upper limit 1200 V)	
2.5	Overcurrent protection	Yes (e.g. rapid-action circuit breaker) $T_{switch\ off} \leq 100$ ms	
2.6	Impedance body - rail	R ≤ 50 mΩ Passenger rolling stock R ≤ 150 mΩ Freight rolling stock	prEN 50153
2.7	EMC	See standard set currently being produced	ENV 50121
3 Current collector			
3.1	Height range	4800 ≤ h ≤ 5750 mm + top of rail	Drw. 20118 page 1 RIB
3.2	Stop holder	5860 mm + top of rail	Drw. 20118 page 1 RIB
3.3	Maximum clearance	100 mm	OVS-BVL-B028
3.4	Maximum angle of contact wire to contact current collector	60 ‰ V ≤ 10 km/h 40 ‰ 10 < V ≤ 30 km/h 20 ‰ 30 < V ≤ 60 km/h 5 ‰ 60 < V ≤ 100 km/h 4 ‰ 100 < V ≤ 120 km/h 3.3 ‰ 120 < V ≤ 160 km/h	EN 50119
3.5	Horned slipper holder width	1900 / 1950 mm	UIC 608
3.6	Horned slipper holder profile	Euro/NS	UIC 608
3.7	Collector shoe material	Metalised coachbon	UIC 608
3.8	Maximum approach	100 mm	
3.9	Minimum approach force	$F_{approach} = F_{average} - 3\sigma = 40$ N	
3.10	Maximum distance front, last current collector	400 m	
3.11	Electrical through connection of current collectors	Not permitted, except on locomotives	

Notes: U_{min2} and overvoltage shorter than 20 ms are not yet recorded in EN 50163; EMC admission requirements are currently being formulated (August 1997).

3.8 Rapid-action circuit breaker (High-voltage switch) (Cat. B)

Acknowledgement: construction guidelines and specifications.

General
The rapid-action circuit breaker serves to shut down currents which exceed a specified preset value, as rapidly as possible. As a result, the high-voltage and/or traction installation on a train set or locomotive and passenger coach is secured against overload or short circuit.

Construction and functional requirements
- The rapid-action circuit breaker must be able to operate reliably at a voltage of up to 2000 Vdc.
- The rapid-action circuit breaker must be sensitive to rapidly rising currents, so that in the event of rapidly rising currents, the shutdown is already initiated, before the preset maximum value is reached (for example in the event of a short circuit).
- The rapid-action circuit breaker must be at least able to continuously bear the maximum taken-up current.
- The rapid-action circuit breaker must be able to shut down an ideal short-circuit current of 100 kA at a time constant of 2.5 ms and 11 kA at a time constant of 2 to 30 ms, in a reliable manner.
- The operation of the extinguishing device in the circuit breaker must be geared towards all currents/current directions occurring in the system, including smaller currents. The occurring arc voltages should cause no damage to the equipment in the installation to be protected, or equipment outside the rolling stock.
- For shutdown as a result of a own maximum operation, the switch must be independent of the external power supply (pneumatic or electrical).
- Shutdown of short-circuit current must be possible at least 2 times per minute, for a period of 2 minutes, and subsequently 2 minutes rest. Addition to the IEC 77 standard.
- The air passage and creep path between high-voltage bearing parts on the one hand, and the low-voltage installation and earth on the other must be sufficiently large, taking account of the occurrence of ionised gases, during shutdown.

Operation/operability
- Shutdown should take place when the own maximum device response, or when a shutdown command is issued from outside.

Installation location
- The rapid-action circuit breaker must be mounted in a box as close as possible to the current collector switch / earth switch.
- The spread of fire in the box must be prevented as far as possible. All materials used must offer sufficient fire resistance.
- The flame arc may not be able to jump to other parts of the installation or earth. The manufacturer of the rapid-action circuit breaker must notify the required insulation separations and space take-up. The manufacturer of the rapid-action circuit breaker box must comply with these indications.

3.9 Aerodynamic aspects (Cat. C)

To be completed.

3.10 Return currents and Safety earthing (Cat. A)

Acknowledgement	UIC 512	electrical resistance wheel set
	UIC 533	safety earthing
	Construction directive return current/safety earthing	

Introduction
This safety requirement is limited to the safety earthing and return current circuit of the rolling stock. The infrastructural section of these circuits, the rails, etc. are not considered here, because these cannot be influenced, by the rolling stock.
Safety earthing should be taken to mean only the earthing of the superstructure. The safety earthing serves to ensure that the high voltage is shut down as rapidly as possible, in the event of a fault in the high-voltage installation, or a break in the contact wire.
The metal composition of the components (frameworks) and the conductive components must therefore be connected to the earth (superstructure) (see also touching risk).

The requirements below relate only to the current 1500 V/4kA network.

Functional and constructive requirements
- The return current system should as far as possible be (electrically) separated from the superstructure and from the safety earthing circuit.
  In train sets, both circuits must be separate.
  In electrical locomotives, both circuits may be linked together, if it is not possible to keep them separate.
- The safety earthing and return current circuit must be built in redundant form.
  If in a train formation the various superstructures are connected with Litz wires, all superstructures must be equipped with at least 1 safety earthing brush holder (redundance for each formation).
  If the superstructures are not linked together with Litz wires, the superstructures must be equipped with at least 2 safety earthing brush holders (redundancy per body), preferably 1 safety earthing brush holder for each bogie.
  In dimensioning the safety earthing circuit, account should be taken of the following:
  - Shutdown behaviour of the substation, in the event of a short circuit.
    The following guideline should be followed:
    - A short circuit current of 100 kA with a shutdown time of 15 ms in the event of a short circuit close to a substation
    - A short circuit current of 11 kA with a shutdown time of between 50 and 100 ms in the event of a short circuit at a point centrally between two substations.

    The shutdown time is the time between the moment that the maximum setting of the rapid-action circuit breaker is exceeded, in the substation, and the moment that the current is 0 A.
  - Redundancy of the system.
  - The maximum resistance between metal parts of the passenger coach and the rails. This may not exceed (UIC 533):
    - 0.05 Ohm for passenger coaches;
    - 0.15 Ohm for freight wagons.
- As far as possible, currents from own installations or from other rolling stock passing through the superstructure should be prevented.
- Damage to the wheel axle bearings as a result of (stray) current passage must be prevented.
- The return current from the main consumer must be discharged to the rail over the shortest possible distance.
- If the return current brush holders are mounted on the axle boxes, the brush holders for both the safety earthing and return current circuit must be evenly distributed over the left-hand and right-hand side of the rolling stock.
- The number of brush holders required for return current and safety earthing current should be spread over the largest possible number of axles.
- The carbon brushes and connector disc of the return current and safety earthing brush holders should be easy to inspect.
- The electrical resistance between the wheel axle and the tyre surface must be as low as possible. The application of Litz wires, etc. with a view to reducing the electrical

resistance is not permitted, except in the case of wheels containing insulation between the inner wheel and the tyre. On these wheels, the wheel or the tyre surface should not be treated by welding, drilling, etc. unless it can be demonstrated that this has no consequences for the mechanical strength and reliability of the wheel.
- The electrical resistance of a wheel set may never exceed 10 mΩ in the case of new built/new tyres, and 100 mΩ in the case of overhaul/reprofiling (UIC 512).
- Other components of rolling stock which for a specified time come into contact with rails (such as the magnetic brake) must be insulated from the bogie and the superstructure.

3.11 Touching safety (Cat. C)

Acknowledgement	NEN 1010	safety determination, low-voltage installations
	NEN 1041	safety determination, high-voltage installations
	prEN 50.122	drawing up protective measures

Electrical areas
- Not sufficiently insulated active parts in passenger coaches must be placed in electrical areas.
  In areas normally accessible for passengers, electrical areas must be effectively sealed off, and only opened using tools or keys (NEN 3140).
  The walls and doors of these electrical areas must offer a degree of protection at least equal to IP4X (protection against solid objects larger than 1 mm) (prEN 50153).
- Electrical areas with active parts with voltages exceeding 1000 Vac or 1500 Vdc may only be opened once the key procedure has been carried out, or once it has been ensured, via other procedures, that active parts have been made safe, and earthed. If these electrical areas are practically never opened, they may be screwed shut (and it should only then be possible to open them with special tools) (prEN 50153).
- Active parts beneath the body must be protected by cupboards or casings, with a degree of protection at least equivalent to IP2X (protection against solid objects larger than 12 mm), such that touching by hand is not possible (NEN 1010 and prEN 50153)

Signalling and information
- Warnings (the broken arrow symbol, see NEN 3011, prEN 50.099 and ISO 3864) must be applied to doors and other access points to electrical areas, containing not sufficiently insulated active parts.
- Warnings must be applied in clearly visible locations (NEN 3140).
- For switches, automatic devices and other control systems, there must be a clear indication of that section of the installation which is switched, and the current setting of the control system (NEN 3140).
- To determine that an item is indeed not live, bipolar measurement must be carried out. This measurement may not be carried out using lamp signalling.

Positioning and arrangement of electrical equipment
- Fuse base holders must be positioned in such a way, or screened from one another so that during changing, there is no risk of short circuit or earth leakage (NEN 1010).

Switching the installation on and off
- If as a result of a fault in an installation or part of an installation, a contact voltage exceeding 50 Vac, 110 Vdc with a ripple of max 1.5% or 120 Vdc without ripple can occur, this installation must be equipped with a safety system which automatically switches off the power supply. The power supply must be shut down within a specified time. This time will depend on the level of the contact voltage (see IEC 364:1992 413.1) (and prEN 50.153 and NEN 1010).

- Having completed the key procedure, or taken sufficient protective measures, a visible separation must have occurred between installations and the catenary. The current collector may not be raised, once the key procedure has been completed.
- It must be possible to shut down installations and parts of installations, and to separate them from all power supply sources. The installation must be sufficiently protected against unintentional switching on (gravity, vibrations or inexpert operation) (prEN 50110).
- Semi-conductors should not be used as separators (NEN 1010).
- Fuse base holders and short-circuit fuse base holders (see the short-circuit device) should be positioned in such a way, or separated from one another, that in the event of exchanging there is no risk of short circuit or earth leakage.
  The bases and short circuit device must be easily accessible and visible from the operating floor.

Earthing

- All metal compositions of components (frameworks) and foreign conductive parts which may become live as a result of a fault, must be linked to the body earth. This does not apply for electrical cupboards, equipped with double insulation (prEN 50.153).
- There should be no switches, etc. in earth and protection connections.
- Earth connections must be easily recognisable (prEN 50.153).
- Earth connections must be correctly dimensioned, and connected (NEN 1010).
- Metal screens on cables carrying a voltage exceeding 1000 V must be earthed.

Capacitors

- Capacitors must have a permanent discharging circuit. The discharging circuit should be connected directly across the capacitor, and must be located close to the capacitor. The discharging circuit may consist of a discharging resistor, or a suitable section of the installation, and must be able to reduce the residual voltage to below 50 V, within 2 minutes following shutdown of the voltage (prEN 50.153).
- The switching of a redundant discharging circuit is permitted if (prEN 50.153):
  - the capacitors and the (extra) discharging circuit are mounted in areas which can only be opened once the key procedure has been completed.
  - this discharging circuit is automatically activated when the key procedure is carried out, and the residual voltage of the capacitor is reduced to below 50 V, within 2 min.
  - a discharging circuit which is automatically activated during the key procedure is not suitable, for technical reasons.
- If once the area is opened, capacitors can be charged, facilities must be installed for preventing direct contact, and to ensure the safe discharge of these capacitors (prEN 50.153).
- The cabling from and to capacitors, short circuit devices and related discharging circuits must be positioned in such a way that it can be inspected visually and by measurement.

3.12 Track load (Cat. A)

Infrastructure-specific rolling stock technical requirements:

Freight rolling stock: (load dimensions)

Static load C2 (according to UIC leaflet 700)
RIB advice required in the case of:
- Load > C2
- Speed > 100 km/h

Static load D2/D4 (according to UIC leaflet 700)
RIB advice required in the case of:
- Deviation from released track sections
- Speed > 80/100 km/h

Passenger rolling stock and locomotives:

Static axle load 21.7 tonnes at track section speed
RIB advice required for:
- Non-released track sections
- Speed > 140 km/h
- Axle load > 21.7 tonnes
- Deviating/special axle configuration

3.13 Communication equipment (Cat. B)

Communication equipment must be provided with the following functionalities:
- compatibility with the existing Telerail (ground-train radio link) infrastructure, see B regulation Part X code C5504/X;
- the power supply to the communication equipment must be designed in such a way that communication remains possible in all cases, and under all circumstances (for example: redundant power supply from and back-up battery in the equipment itself);
- selective calls according to train number must be possible;
- alarm calls should interrupt existing connections.

3.14 Braking and compressed air systems (Cat. C)

The compressor capacity must be sufficient to power the brake system, even under unfavourable circumstances (for example multiple activation of anti-block installations).

The guideline for the minimum compressor capacity is:

Compressor capacity (l/min) at 8 ± 1 bar, at maximum speed	300	500	800	1000	1250	1500	2000
Maximum number of axles to be braked	6	12	28	44	52	80	104
Minimum main reservoir volume (l)	200	200	280	440	520	800	800

Crash safety of braking equipment: braking equipment must be mounted in and beneath the superstructure in such a way that it is well protected in the event of collisions (minimise loss of function).
EMg and PMg brakes are in principle permitted on the NL network (assessment per type of MG brake and positioning beneath type of bogie is necessary, including PVR and running characteristics).
Train sets, locomotives and passenger coaches which in connection with construction, mass and braking are sensitive to blocking and/or whereby unacceptable braking distance extensions occur under poor adhesion conditions must be fitted with an anti-blocking brake

installation, and sufficient magnetic brakes, distributed in such a way across the rolling stock, that blocking of the wheels can be successfully countered.
The operating force for the emergency brake handle must not exceed 200 N.
Only braking systems recognised by RnV as safety brakes may be included in determining the maximum permissible speed, from the point of view of braking distances/speed .

3.15 Miscellaneous (Cat. C)

Generally speaking, for the category miscellaneous , the following guidelines should be maintained:

a both in the passenger compartments and in the personnel areas, protruding parts and sharp edges on which passengers or personnel could be injured under normal circumstances or in the event of collisions, must be avoided. For maintenance personnel, sharp, protruding parts beneath the rolling stock should also be avoided, as far as possible. Points and corners of suspension brackets, etc. must be rounded.

b all components in the interior must be constructed in such a way that unwanted removal or breaking, except in the event of extreme vandalism, is not possible. This applies to ceiling panels and hatches, and furniture rests. All parts must be capable of withstanding acceleration rates of 3g, without loss of function.

c all windows fitted in rolling stock must be manufactured from good quality, hardened reflective glass, with a minimum thickness of 5 mm. The glass panels of measuring instruments and the cover panels on emergency facilities are excluded from these requirements.
If windows are fitted with tools which permit exit in emergency situations, they must be constructed in such a way that the unwanted falling out of the windows is avoided.

d If movable windows are necessary, they must be constructed in such a way that when open, no body parts can be extended outside.

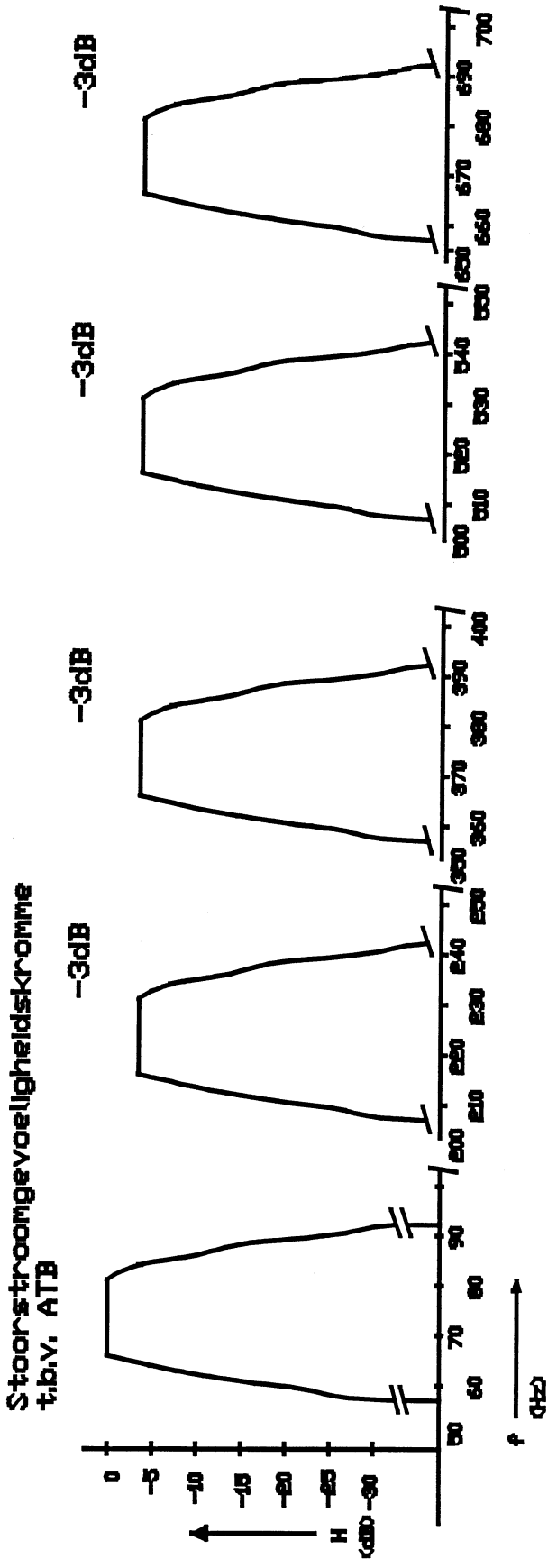
e covers, doors and flaps which give access to areas in which high-voltage equipment is located, and the permanent covers on this equipment, must be marked by a clearly visible high-voltage indicator.
Parts carrying high voltages must be protected against contact.
For access to equipment boxes and other areas in which high voltages may be present, and in which short-term maintenance work and remedy of defects is regularly carried out, a locking procedure must be included.
The locking procedure for these cupboards and areas must be determined in further consultation with the admission authority. For the sealing of high-voltage cupboards and areas, which need not regularly be opened, other measures may be taken, such as closure with bolts, in consultation with the admission authority.

f outside technical areas, voltages 220/380 Vac, 110 Vdc and 72 Vdc must be fully protected.

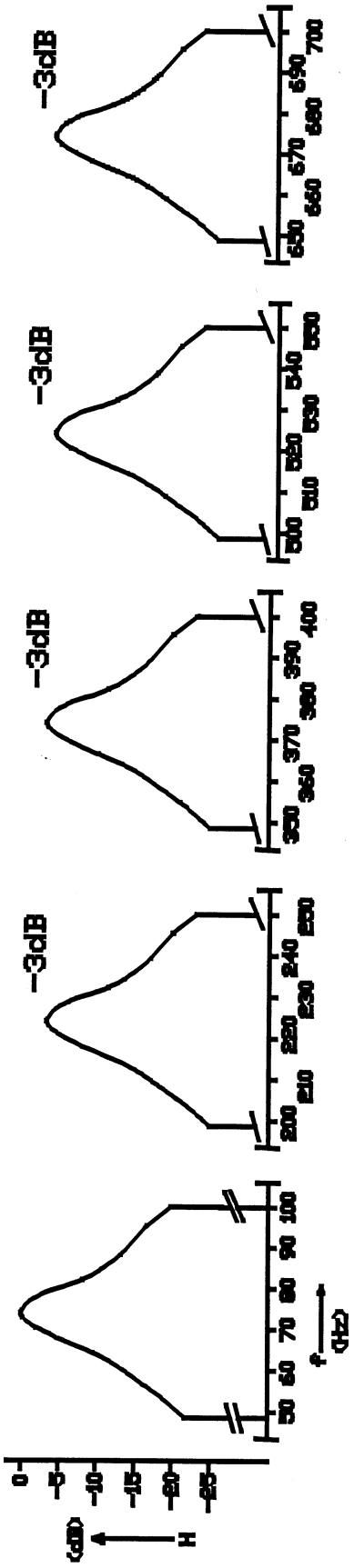
g the materials used in a train must have fire-retardant characteristics.

h. luggage racks must be constructed in such a way that luggage cannot fall off as a result of large longitudinal shifts.

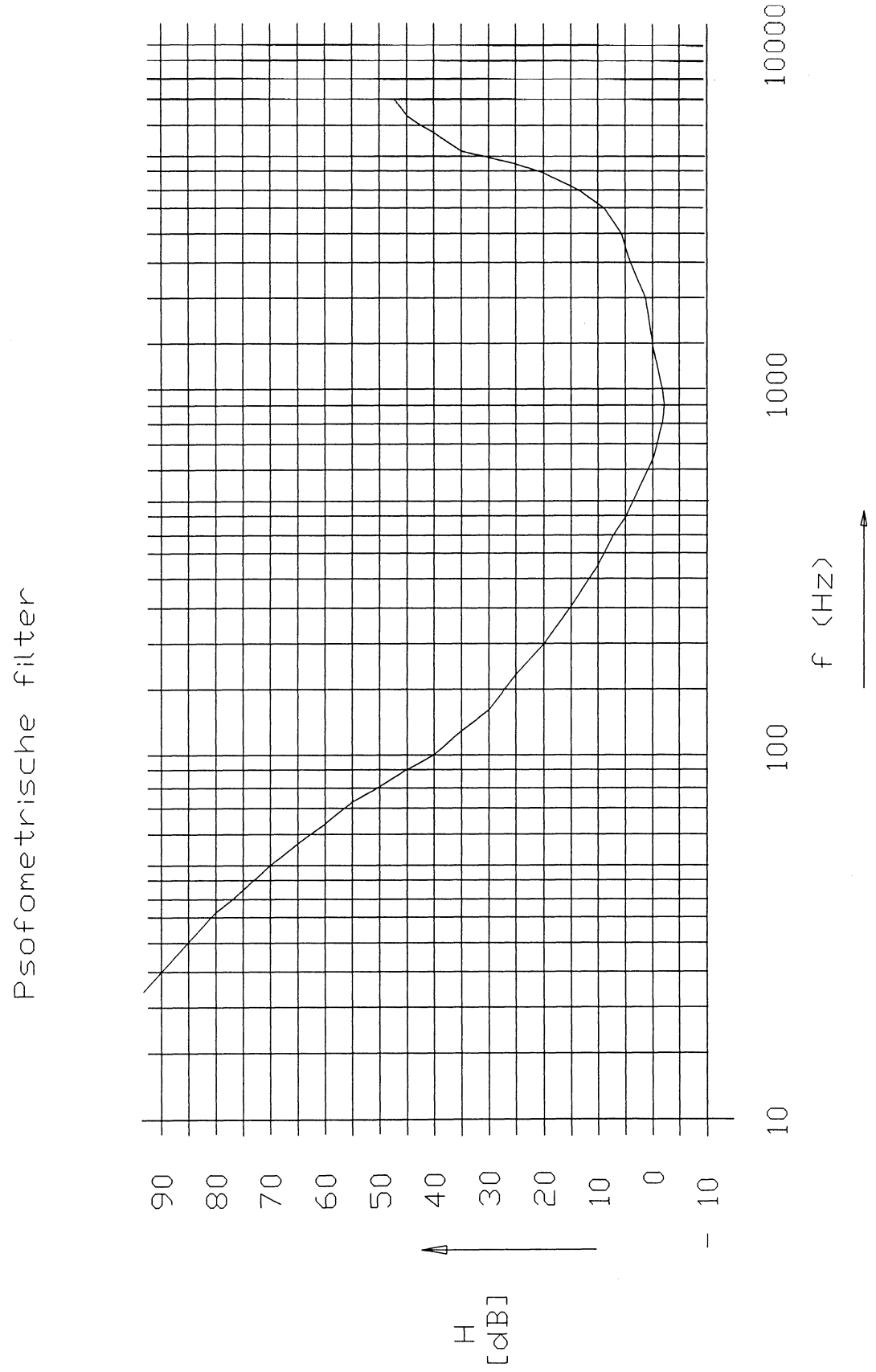
Appendix 1 Interference current sensitivity curve for ATB



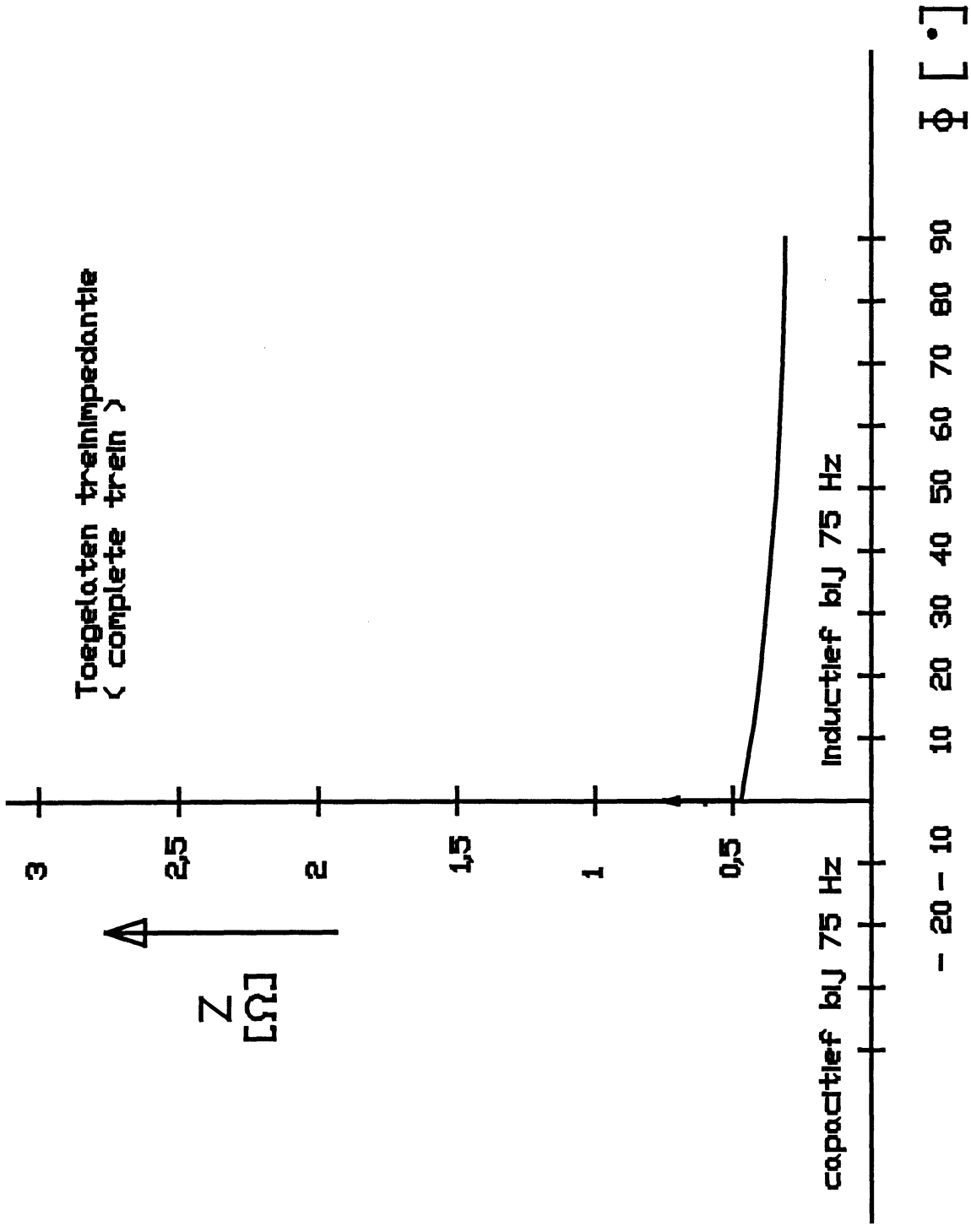
Appendix 2 Filter characteristic for protection interference current



Appendix 3 Filter curve for psophometric values, traction return current

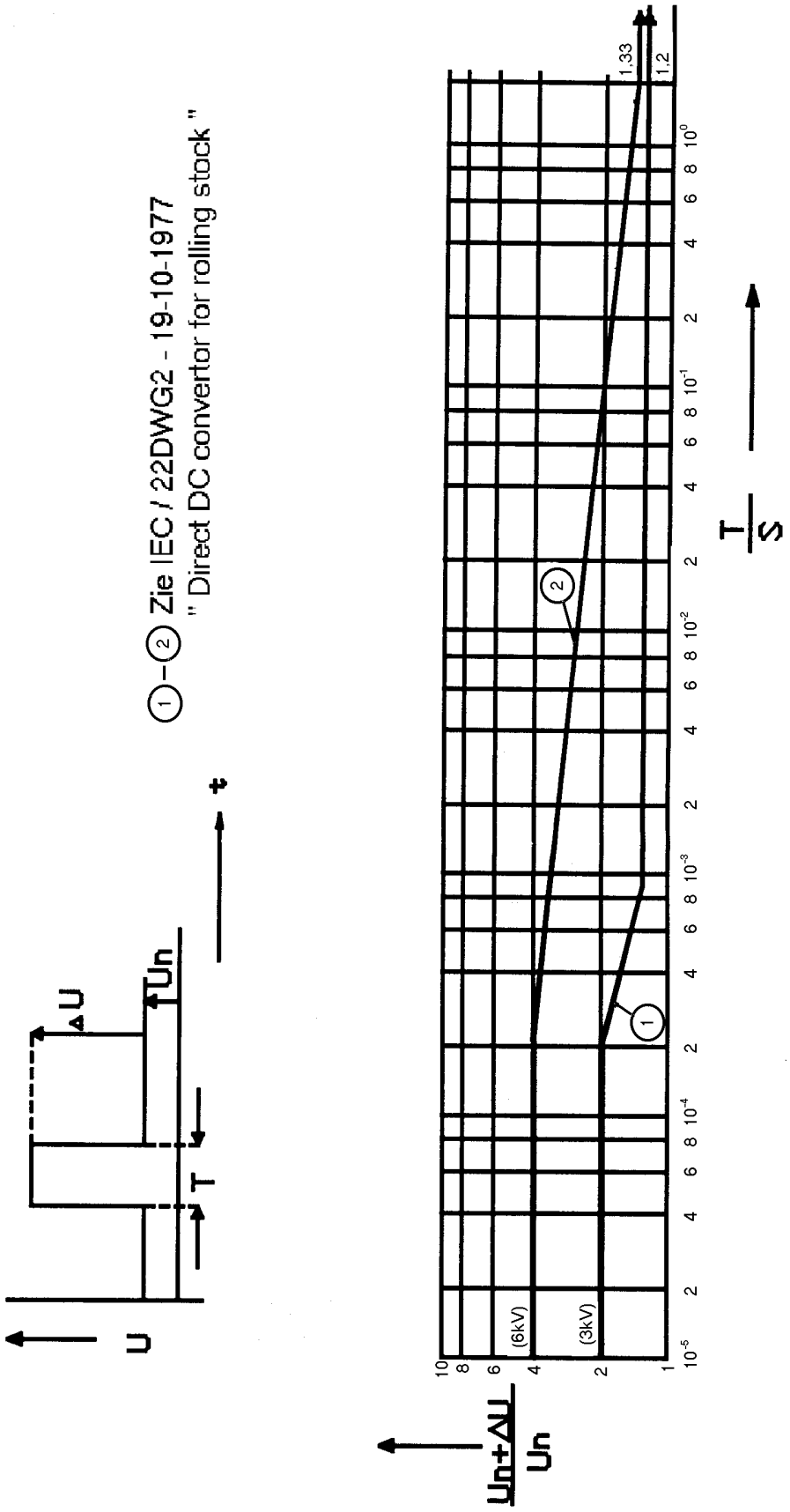


Appendix 4 Minimum values for train impedance



Appendix 5 Power supply voltage jumps

Replaces figure 6 from IEC 411-4



Appendix 6 GENERAL SAFETY PHILOSOPHY

1. General safety philosophy

This standard describes the current state of technological advance. If the carrier acquires rolling stock, in the framework of his own responsibility as a carrier he will also have to take account of the way in which he selects solutions for the points listed in this safety philosophy, against the background of the safety philosophy.

2. Safety and availability of rolling stock

The primary function of a train is to transport passengers and goods as comfortably as possible, safely and punctually, whilst ensuring the lowest possible level of energy consumption.
In order to achieve these functions, four main function groups are identified:

- Safety functions
- Performance functions
- Comfort functions
- Supply and help functions

This safety philosophy will deal exclusively with the safety functions , whilst the carrier will have to determine his own priority for performance, comfort, supply and help functions .

3. Safety philosophy

RnV considers it of vital importance that in addition to collision and derailing safety, the systems are designed in such a way that they guarantee a sufficient level of safe functioning (system safety).
(Railway) safety is taken to mean: "The degree of absence of risk in and due to a rail transport system. Risk relates to injury and damage . A safety function is a function in connection with which non (or incorrect) compliance can have a negative influence on maintaining a sufficiently high level of safety.
Safety disruptions are caused by technical faults, human operating errors, or a combination of technical failure and human operating error, resulting in the non (or incorrect) fulfilment of a safety function. The risk which arises in the event of a safety disruption is the product of the likelihood of the non (or incorrect) fulfilment of a safety function, and the seriousness of the consequences of the occurrence of the safety disruption.

Certain functions can only be viewed as safe if the operation of the rolling stock takes place according to the correct procedures (for example: departure procedure in combination with central door operation, faulty AVD installation, and the deployment of the second man, etc.). Evaluation of these procedures is not covered by this standard and will be carried out upon the issuing of the safety certificate according to standard V-002 Procedure for obtaining a safety certificate .

In order to manage risks, the requirements in respect of fulfilling a safety function must be made dependent on the expected consequences of a safety disruption in respect of this function. However, it is not always easily possible to quantify the expected consequences of a safety disruption.
In order to nonetheless be able to assess whether the number of safety disruptions in respect of a specific function is acceptable or unacceptable, and in order to be able to lay down priorities in reducing risks, the safety functions will be classified in three categories:

I : small risk of very serious consequences
II : very small risk of very serious consequences, small risk of serious consequences
III : very small risk of serious consequences
Small risk: unlikely but possible

Very small risk: extremely unlikely
Serious consequences:one serious casualty and/or several casualties
Very serious consequences deaths and/or several serious casualties

In addition to safety functions, there are a number of other functions which in the event of a (possible threat of) non-fulfilment of a safety function can intervene or issue warnings.

b monitoring function:
monitoring a safety function, and in the event of failure possibly intervening in such a way that a safe situation is achieved.

w warning function:
warning (operating) personnel or third parties, to prevent human errors.
The supplier of a system required to fulfil a safety function must demonstrate to the admission authority that his system functions sufficiently safely.

Depending on the level of risk, certain design criteria apply.

The general criteria applicable for every safety function are as follows:
1 a single fault in a single component taking account of faults which may arise as a consequence may not result in a system no longer being able to (fully) fulfil its safety function(s)
2 if two faults occurring simultaneously may mean that a safety function can no longer be fulfilled, these faults must be independent of one another and, following occurrence, must not manifest themselves in a dangerous manner. In this connection, it must be demonstrated that the risk of occurrence of the second fault, before the first fault has been noted and corrected, is sufficiently small, as judged by RnV.

In addition, the following requirement applies:
3 if certain system components do not comply with the above mentioned design criteria, this will only be acceptable on condition that the supplier is able to convince the admission authority that the risk of unsafe failure is infinitesimally small.

In connection with the above, account must be taken of the fact that the normal operating elements can be operated at any moment.

For the admission authority, knowledge of the construction and experience with likelihood of failure is necessary, in order to be able to evaluate and possibly admit the degree of deviation from the first two criteria.

In the framework of system safety, **no** account is taken of the use of systems outside the specifications, the influence of insufficient maintenance, etc.

The requirements imposed are qualitative, and serve as a basis for the evaluation of new constructions, or alterations to existing constructions.

In addition to qualitative requirements, quantitative requirements will also be imposed. For electronic safety functions (protection, automatic train control, etc.), quantitative requirements have already been internationally laid down, see CENELEC 50.126 50.129. In the future, the quantitative requirements for other safety functions will also be laid down, and until that time at least the stand still principle will apply.

4. Safety functions

The figures and letters in front of the function indicate the level of importance (I, II, III), and whether the function is a monitoring function (b) or warning function (w).

4.1 Brake system

I rapid braking[1)] initiated by driver
II rapid braking[1)] following operation of alarm signal handle (including signal to driver)
II rear part braking
b rapid braking[1)] initiated by ATB device
b rapid braking[1)] initiated by automatic vigilance device
b braking as a result of train disconnection

[1)] In the event of rapid braking, braking deceleration retardation must be achieved equivalent to or greater than the required braking percentage of the train. An order should also be issued, to shut down traction power.

4.2 Automatic Vigilance Device

b to monitor the presence and capability of the driver to act.

4.3 ATB device

II cab signalling
b monitoring the control of train systems by the driver in such a way that the train will not achieve or maintain an unsafe high speed.

4.4 Traction system

I shuts down traction force in the event of rapid braking
I if the ED brake is included in the braking weight, providing ED braking force in the event of rapid braking.
II non-switching on of traction force, if not requested.

4.5 Air supply system

II raising and maintaining the pneumatic network at operating pressure

4.6 Door system

I outside doors: closing doors and keeping them locked during running, in passenger service (including signalling)
III outside doors: opening and keeping doors opened, by means of an emergency power device at low speed
III preventing passengers becoming trapped, during opening and closing of doors
b signalling: correctly issuing an order of departure
b inside doors: releasing escape routes from the train and keeping them open
b cab doors: releasing escape routes from the train or cab
w signalling: signalling the loss of door locking capacity

4.7 Lighting system

II front and rear signals: signals at front and rear of the train
III interior emergency lighting (escape routes from the train)

4.8 Horn device (including heating)

w switching on the high and low tone horn, and maintaining operation

4.9 Visibility (windscreen wiper)

III good perceptibility of signals and other relevant information outside the train

4.10 Running gear

I conduction of the train in x, y and z direction
II suspension of components

4.11 Buffing and draw gear

II keeping the train units coupled
I uninterrupted transmission of safety information

4.12 Body construction

I keeping all parts mounted on and in the body within the limits of the gauge

4.13 Communication

w issuing alarms to approaching trains if the infrastructure cannot be safely used