PeaK

Cemafroid

Measurement methods for PeaK noise during loading and unloading

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Foreword

These are the Peak measurement methods for PEAK noise during loading and unloading (2024 update), published by Cemafroid.

Peak aims to certify products and vehicles that meet the noise standard set by Cemafroid and have been tested according to the Peak measurement methods.
PEAK certified products contribute to reducing noise emissions during loading and unloading operations and thus enable evening/night delivery within the legal frameworks.
These measurement methods are intended for everyone involved in producing and marketing new equipment and materials used in loading and unloading goods in the retail trade.
The Dutch legislation on noise (Environmental Act) relates to immission, the sound level on the facade. Despite the fact that every effort has been made for a Peak certified product, it is possible that the legal noise standards are not met in certain loading/unloading situations. The relation between vehicle sound emission and sound immission at receiver depends on many factors, all falling within the three categories: sound sources, sound transmission/propagation and receiver point. In other words the sound from the vehicle or the activity, the venue consisting of the surrounding buildings and walls, parks or open lands, etc, and finally the absorption and bending of the propagating sound in the air – the ambient temperature, humidity and air pressure constitute the media of the propagating sound wave.

A measurement and report in accordance with the Peak methods of measurement for PEAK noise during loading and unloading (2024 update) enables participants of Cemafroid to have their component type-approval certified under Peak.
All products relevant for Peak that are present in the certified vehicle shall be part of a Peak or QuietTRUCK type approval. The products comply in that case with the PEAK values measured according to the Peak measurement methods.

Changes to this version:

Substantial changes to the Measurement methods for PEAK noise during loading and unloading (2024 update) were made. These changes can be found in chapters 1, 2, 3 and 4 amongst others. Parts of the text have been updated, elucidated and amended in order to reflect current understandings and standards. Part of the existing text has been moved and the order has been changed. The most relevant changes are as follows:

- Paragraph 1.4 the definition of N_{rated} is aligned with the UN/ECE Regulation No 85.
- In chapter 2 the limits for Cemafroid Certification are changed. The transitional provisions are changed to the new situations. To determine the product family of QuietTRUCK a different approach is taken, from worst case to representative vehicle. The Conformity Of Production (CoP) for QuietTRUCK is also adjusted.
- In Chapter 3, the requirements for the testing area are further clarified.
- The methods of measurement for the QuietTRUCK dealt with in chapter 4 are now more in line with international type-approval requirements for vehicles in accordance with UN/ECE Regulation No 51 related to the Vehicle Sound Emissions and UN/ECE Regulation No 165 and UN/ECE Regulation No 138 related to the audible reverse warning signals.
- In chapter 5 measurement methods for determine the speed of closing the cabin doors are added.
- In paragraph 6.3 the hardness of the wheels of the ‘quiet’ roll cotainer is more specified.
- Paragraph 6.4 has been clarified for protruding parts on the wall and front end. And an omission between the text and images regarding the position of the bullet and wall has been corrected.
- The measurement method is described in a different way in paragraph 7.1.
- In Chapter 11 it is clarified what information shall be at least in the test report that will be used for applying for a Peak or QuietTRUCK type-approval certificat.

Summary

This document describes the methods of measurement that are suitable for determining the peak noise levels of various sound sources during loading and unloading. Peak in general and these methods of measurement are specifically intendend for the certification of products during loading and unloading at retailers or shops. They are not intended for other means like the reduction of normal road-traffic noise. The methods of measurement provide peak sound levels of single sources under controlled conditions at a distance of 7.5 metres from the source.

The methods of measurement are set up to yield both representative and reproducible results, which approach the practical conditions as closely as possible. The methods are set up in such a way that noise-reducing measures are clearly expressed in the measurement results.

The Peak certification values can be used to obtain an indication of whether the product in question will meet the required sound immision limits in most practical situations and provide the local authority with a tool for assessing the potential of a Peak certified product or a QuietTRUCK vehicle in relation to the environmental goals. Furthermore, the methods of measurement are used to compare the peak noise emissions of products with each other.

The methods include:

- Driving noise for trucks, noise caused by cabin doors
- Doors, hatches, hinged and roller doors and sliding partition, steps and strip curtains of cargo body and/or load compartments.
- Tail lift, body floors and walls of commercial vehicles
- Shopping trolleys, goods carts, rollies, dollies and hand pallet trucks
- Fork lift trucks and mobile fork lift trucks
- Transport refrigeration system

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1. Introduction

The 2024 Peak test protocol aims at aliging with the Environment and Planning Act (Omgevingswet) and the loading and unloading situations at stores.
This report describes methods of measurement that are suitable for determining the peak noise levels of relevant sources of noise during loading and unloading. The measurement methods determine PEAK noise levels for single sources under controlled conditions at a distance of 7.5 metres from the source. The measurement methods are set up to yield both representative and reproducible results, which approach the practical conditions as closely as possible. Furthermore, the methods of measurement are set up in such a way that the noise-reducing measures are clearly expressed in the measurement results.

Technology develops at lightning speed; Peak is no exception to this. This protocol incorporates the relevant innovations. Furthermore, the experiences with the update of the 2018 mearurement methods and the proposals of ACEA for the measurement methods for QuietTRUCK are incorporated in the 2024 update Peak test protocol.

1.1 Objective, background and scope of the methods of measurement

Dutch law on peak noise during loading and unloading (the Decree Environment and Planning Act planned to be in force on 1 January 2024) applies to the peak noise level at any outside wall of a building nearby the activity in practical conditions.
The stated levels of the Peak certified product can be used to obtain an indication of whether the product in question will meet the legal limit values in most practical situations. It may be, however, that the combination of the Peak certified product and the acoustic environment, the method of operation and the state of maintenance of the product will affect the sound immission level in an real situation.
Furthermore, the methods of measurement can be used to compare the peak noise emissions of products with each other.
The methods of measurement are intended to evaluate partial sources in their practical conditions, where there is interaction with other components. To receive reproducible measurements some measurement methodes are not in line with practical conditions. An example of this is the simulation of a roller containter in a collision with the wall, whereas the roller container does not makes the collision to the wall during the measurement but a steel ball.
The methods are not suitable for determining the sound power.

1.2 Directionality

Many sound sources have directional sound radiation, which means that sound levels vary depending on the direction from which sound radiates. As sound can be observed in all possible directions in terms of the sound source in inner-city situations (both around and above the noise source), the measured level should be the maximum sound level from all possible radiation directions. This type of measurement may require disproportionate measurement efforts in practice, especially in the case of highly variable noises. For practical reasons, the aim therefore was to prescribe as few measuring points as possible. The radiation directions that are expected to be most critical, however,

were taken into account. For some sound sources, such as moving vehicles, it is difficult to measure in all radiation directions. Here it was decided, in accordance with international regulations, to measure to the left and right of the travelling path of the vehicle only. Conversely, the method of measurement shall not result in sound-limiting measures being designed so that the maximum effects are achieved only in the direction of the measuring points indicated in this report. A example of less than optimal design (for inner-city use) is transport refrigeration systems installed at the front end of a cargo body. The insulating enclosure is often designed in such a way that an effect is achieved horizontally, but little effect upwards. The top of the enclosure is usually left open.

1.3 PEAK mode

For various prodycts/machines present on a vehicle, the speed of functioning may affect the sound level produced by the part. Examples of this are the revolution of the (electric) motor of a refrigeration or a truck's engine. If the part has two speeds and the product/machine is tested at the low speed setting, this is called "PEAK mode".

If a product or machine has a PEAK mode it should activate automatically and should not function dependent on the actions of the driver. PEAK mode shall ensure that the part/machine meets the PEAK sound requirements within a distance of 300 metres from the loading/unloading location.

The basic principle of a PEAK mode is that it is driver-independent and that, outside of the PEAK-specified time frames and outside of the so-called PEAK locations, the machine can be set to maximum power (for example software) with technical tools. In other words, PEAK mode is the default operating setting of the machine.
In case of a defect in the technical tool or other faults relating to the functioning of PEAK mode, the part/machine shall operate in PEAK mode. The functioning of PEAK mode shall be guaranteed. The functioning of PEAK mode shall also be demonstrated and described in the report.

The above listed demands do not apply to Driveline and Acoustic Safety systems sound of trucks (in accordance with Chapter 4). The PEAK mode for QuietTRUCK may be operated manually and does not need to be driver-independent. Vehicles which require driver intervention to switch on the PEAK mode should switch this function on as soon as they enter a zone of 300 metres surrounding the loading/unloading location.

In the case the PEAK mode is automaticaly activated – geofencing/time of the day – it is allowed to activate the PEAK mode by software during the tests if necessary.

1.4 Definitions

- n_{rated}: The rated engine speed means the declared engine speed in min^{-1} (RPM) at which the engine develops its rated maximum net power pursuant to UN/ECE Regulation No 85 or, where the rated maximum net power is reached at several engine speeds, the highest one of those speeds is taken.

- n_{max}: The highest engine speed which can be achieved without engine load.
- $n_{max\ reduced}$: The maximum idling speed in the event that a reduced PEAK mode in engine management has been activated.
- P_n: Rated maximum net power, the engine power available for propulsion expressed in kW and measured by the method pursuant to UN/ECE Regulation No 85 and stated in the Vehicle Type Approval.
- m_{test}: The total mass of the vehicle that is being tested is the actual weight during the measurement including the driver, measurement equipment, in case needed the added mass in accordance with paragarph 4.1 etc.
- PEAK mode: A deliberately changed operating condition in a product with the goal of temporarily reducing sound production.
- Vehicle: a motor vehicle with or without a (semi) trailer or a (semi) trailer
- Truck: a motor vehicle designed and constructed primarily for the carriage of goods of categories N2 or N3 as defined in the EU Regulation 2018/858
    - N2: motor vehicles with a maximum mass exceeding 3,5 tonnes but not exceeding 12 tonnes
    - N3: motor vehicles with a maximum mass exceeding 12 tonnes
- Trailer: means any non-self-propelled vehicle on wheels designed and constructed to be towed by a motor vehicle.
- Semi-trailer: a towed vehicle in which the axle, or axles are positioned behind the centre of gravity of the vehicle.
- Target object: the object being tested, either a product as specified in chapters 5 to 10 or a vehicle (including added mass) and test equipment. In case the product is mounted to a vehicle, the vehicle is part of the target object. In case the product is part of a vehicle cargo body the vehicle cargo body shall to be complete/ready build for the purpose of the test.
- Participant: company affiliated by Cemafroid.
- LpA, max: maximum measured A-weighted Sound Pressure Level with integration Time set to “FAST”.

2. Product certification requirements

2.1 Limits per product

The sound level of the product being certified may, in accordance with the protocol described below, never exceed the following limit values:

	Limit (dB(A))*
QuietTRUCK – driveline	72
QuietTRUCK – (cabin) doors and compressed air noise	67**
QuietTRUCK - Reversing alarm system and blind spot warning system	62
Other products	62

* These are the limits for Cemafroid Certification. Other organizations and goverment may apply different limit values (e.g. for subsidy purposes).

** For compressed air noise, opening and closing of (cabin)doors which are part of the vehicle body which contains the driver compartment the limit is 67 dB(A). For doors of loading aeras built by a body builder the limit is 62 dB(A)

2.2 Mandatory measurement methods per product

Chapters 4 up to and including 10 describe the measurement methods for the various products. One or more measurement methods may need to be executed during the certification process depending on the type of product.

Multiple measurement methods shall be executed in accordance with the list below for the following products. All measurements shall meet the limit values in paragraph 2.1, unless explicitly stated otherwise. The final result per product is the highest value of the methods of measurement listed.

It is possible, that some products used during loading and unloading, are not covered by the measurements methods in this document. It is also possible that product can be operated in an extra way then covered by the measurements methods in this document. If one of there situations is the case, please contact Cemafroid.

2.2.1 QuietTRUCK

The following measurements shall be carried out when certifying a QuietTRUCK:

- The following values shall be measured and reported and they shall meet the limit values included in paragraph 2.1 (normative), with the following remarks:
  - Paragraph 4.2 Acceleration
    In case a UN/ECE Regulation No 138 device is installed, it is considered part of the driveline sound.
    In case the UN/ECE Regulation No 138 reverse test result is higher than the UN Regulation No. 138 20 km/h forward motion test result, the UN/ECE Regulation No 138 reverse test result shall be reported.

This value can be can be taken from the UN/ECE Regulation No 138 certificate after it

has been converted from the 2 meter recording position in accordance with the UN/ECE Regulation No R138 to the sound pressure level corresponding to 7,5 meter distance between microphone and sound source, in according to the Peak test methods. The calculated sound pressure level is achieved by reducing the 2 m value by 9 dB(A), as described by formula: $L_{pA,\ max,\ 7.5m\ calculated\text{-}Reverse} = L_{pA,\ max,\ 2m\ UN\ R138} - 9$ dB.

- Paragraph 4.3 Compressed air noise
  In case the compressed air noise measured in accordance to the UN/ECE Regulation No. R51.03 Annex 5 complies with the reqiurements in paragraph 2.1. in this document these values can be used to prove compliance with the QuietTRUCK limits. The relevant information from the UN/ECE Regulation No R51-03 homologation test has to be shared. In this case no additional measurements are required.
- Paragraph 4.4: Reversing alarm system and/or blind spot warning system
  The UN/ECE Regulation No 165 homologation test result can also be used to prove compliance with the Peak limits as specified in paragraph 2.1. The relevant information from the UN/ECE Regulation No 165 homologation test is to be shared. In that case no additional measurements are requiered.
- Paragraph 5.2 Cabin doors (informative until limits become applicable according to the transitional provisions (see paragraph 2.7)

- The following values shall be measured and reported but they do not need to meet the limit values included in paragraph 2.1 (informative)
  - Paragraph 4.5 pass by noise (measured in conformity with UN/ECE Regulation No 51.03 Annex 3)
    If PEAK-mode is applied then the pass-by noise for the vehicle in motion is measured in accordance with the procedures described in UN/ECE Regulation No 51.03 Annex 3 [3] and reported. Otherwise report the value in accordance with the UN/ECE Regulation No R51.03 certificate.

2.2.2 Tail lift

To certify a tail lift, it shall pass the following measurements:

- 6.2.1 Opening and closing
- 6.2.2 Roll-off stop
- 6.3.1 Rolling over the tail lift
- 6.3.3 Rolling over transitions

2.2.3 Clamping blocks

When the clamping blocks can be placed in the fastening rail and can be changed in the high in the fastening rails then it shall pass the following measurements:

- 6.5.2 Clamping blocks placing
- 6.5.3 Clamping blocks moving in hight

2.2.4 Pallet truck

To certify a pallet truck, it shall pass the following measurements:

- 7.1 Rolling noise
- 7.3 Lowering and raising

2.2.5 Roll container

To certify a roll container, it shall pass the following measurements:

- 8.1.1 Loaded
- 8.1.2 Rolling nested roll containers or
- 8.1.3 Rolling empty roll containers that cannot be nested
- 8.2 Colliding/nesting roll containers
- 8.3 Placing and removing additional loading shelves

2.2.6 Rolly or dolly

To certify a rolly or dolly, it shall pass the following measurements:

- 8.1.1 Loaded
- 8.1.4 Rolling stacked rollies and dollies
- 8.4 Stacking rollies and dollies

2.2.7 Forklift truck

To certify a forklift truck, it shall pass the following measurements:

- 9.1 Driving
- 9.2 Evaluation of lifting

2.2.8 Mobile forklift truck

To certify a mobile forklift truck, it shall pass the following measurements:

- 9.1 Driving
- 9.2 Evaluation of lifting
- 9.3 Evaluation of connecting mobile forklift truck

2.3 Product family, worst-case and representative samples

In principle, Peak type-approvalcertificates are issued for a single product or for a series of identical products. To certify a series of identical products, PEAK sound measurements shall be carried out on a (random) sample(s) from that series. In case the measurement method requires multiple products, example for roll containers and dollies, these multiple products shall be selected randomly.

To apply a type-approval certificate of a product family of acoustically equivalent products a measurement has to be executed with the worst-case specification of the products within of the Product family or in case of a QuietTRUCK type-approval certificate with a representative vehicle. We recommend the participant to contact Cemafroid in advance for advice about the worst-case product or representative vehicle. PEAK sound measurements carried out for a product
which is not the theoretical worst-case or representative vehicle within a product family will result in the allocation of a de facto upper limit for the products or vehicles for this product family. This

means that other products are assumed to be noisier following an analysis of the criteria featured in the table will not be considered as part of the product family of concern.

2.3.1 Worst-case

On request from the participant permission will be granted for the use of product families of acoustically equivalent products. The most important noise sources (like the motor or platform) are identical within a family. The parts or characteristics which are less important to noise production may differ within a family. However, PEAK sound measurements shall be carried out under
"Worst-case scenario" conditions for the Product family in question. In other words, the product within a family of products which is expected to produce the most noise shall be tested.
The participant is responsible that all products in the family covered by the worst case are compliant with the corresponding measurement methods update 2024 and the Peak type-approval certification value.

2.3.2 Representative vehicle

When a Peak participant request a type-approval certificate for a Product family of acoustically equivalent products for a QuietTRUCK, a representative vehicle is used for the measurement.

The representative vehicle is chosen by the participant according to the list below and shall follow the directions outlined in the UN/ECE Regulation No 51.03, see also Annex B of this document. The participant is responsible that all vehicles in the family covered by the representative vehicle comply with the measurement methods and the QuietTRUCK type-approval certification values (driveline and the value for the non-driveline noise topics). In some cases, permission will be granted to demonstrate representative vehicle specification using the measurement results obtained during the vehicle type-approval (see paragraph 2.2.1).

Vehicle component	**Representative vehicle for QuietTRUCK type-approval certification**
Engine	Shall follow the type definition in the UN/ECE Regulation 51.03. The engine from a family has to be chosen with the highest power output.
Engine compartment	The shape or materials of the engine compartment and its sound proofing shall be considered in line with the UN/ECE Regulation 51-03.
Exhaust	The position of the opening (left, right, low, high) and the order of pipes and dampers is relevant. The configuration that resulted in the highest L_{urban} in accordance with the UN/ECE Regulation No 51.03 or as noted in the type-approval certificate or by (pre-)testing according to the applicable test methods in this document has to be taken into account. The participant is allowed to make the pre-testing.

(Side) skirts, covers, underrun protection*	Shall be as small and as bare as possible, with minimal acoustic absorption and/or shielding.
Vehicle body*	Shall be as small and as bare as possible, with minimal acoustic absorption and/or shielding.

(*)A vehicle which has been fitted with separate (side) cover or separate body etc. will be deemed to be representative of the whole vehicle family. It will be assumed that all vehicles within this family have been equipped with the same side cover or body etc., or with a side cover or body which offers the same acoustic reduction.

2.3.3 Type-approval certification value

Products where the measurement result does not exceed the limits stated in paragraph 2.1 'Limits per product' may qualify for a Peak or QuietTRUCK type-approval certificate.
The participant can request Cemafroid to use a higher value for certification than the measurement result in the test report approved by Peak. The requested higher certification value can never exceed the limits stated in 2.1 'Limits per product'.
The requested and approved higher certification value will be used on the Peak type-approval certificate, the website and will apply as a reference for the spot checks and Conformity Of Production (COP).

2.4 Product conformity

PEAK type-approval certificates are issued for a series of identical products or for a family of acoustically comparable products. The sound requirements are applicable to both the representative sample(s) used during testing and to the other products in that series which are produced by the participant.

2.4.1 Peak certified products except QuietTRUCK

Cemafroid may execute spot checks to help verify this product conformity.
Failing a noise value spot check by more than 1 dB(A) may result in a second and third spot check being carried out. Cemafroid retains the right to withdraw PEAK certification until a participant can prove that their products are in conformity with PEAK demands if more than one noise value spot check is failed by more than 1 dB(A).

2.4.2 Product conformity of QuietTRUCK

The Product family and product conformity of QuietTRUCK is being monitored through Conformity Of Production (COP). The conformity of production procedures applicable to the QuietTRUCK label shall comply with the requirements in paragraph 2.4.2 and subparagraphs. For the different roles in the COP see annex B of this document.

2.4.2.1 Verificaton of COP process

The authority which has granted QuietTRUCK type-approval may at any time verifies the conformity control methods applied in each production facility. The normal frequency of these verifications shall be one every two years.

2.4.2.2 COP selection scheme

Appropriate flexibility towards Conformity of production (COP) should be based on the number of

produced QuietTRUCK certified vehicles per year, counting from date of issue of the QuietTRUCK type-approval certificate.

Quantitative annual limits		**Minimum COP-frequency**
Exceeding	Up to	
0	10	On request of Cemafroid (after 30 produced vehicles)
10	35	1 per 3 years
35	50	1 per 2 years
50		2 per 2 years

In case of a temporary halt or termination of production Cemafroid shall waive the COP obligation, at the request of the participant, for the period when no vehicles according to the QuietTRUCK type-approval certificate are produced.

2.4.2.3 Specification of the vehicle for COP test

The truck, approved for QuietTRUCK, and subject for COP-test shall in general be randomly chosen from production line.

Cemafroid (or a technical service on behalf of Cemafroid) may request a certain specification for the next COP test. The participant performs the COP test on the vehicle with the requested specification when such a vehicle is available. If the requested specification is not produced six months before the deadline according to paragraph 2.4.2.2 a random QuietTRUCK (which may or may not meet the requested specification) shall be tested instead.

2.4.2.4 Measuring conditions and methods

The test site and measuring instruments shall be those as described in paragraphs 3.1 and 3.2. The test vehicle shall be subjected to the tests set out in paragraphs 4.2, 4.3, 4.4 and 5.2. Aspects which are in the monitoring phase, such as door closing sound, are exempted from COP.

2.4.2.5 Fulfilling COP

The vehicle type shall be considered to conform to the requirements of QuietTRUCK in this document if the sound level value for driveline and the value for the non-driveline noise topics of the vehicle tested during COP test does not exceed the type-approval certification values by more than 1 dB(A). The vehicle type shall be considered to conform to the requirements of QuietTRUCK in this document.

If one of the test results does not fulfil the COP, two more vehicles of the same type (as defined in 2.3) shall be tested. If the test results for the second and the third vehicle fulfil the COP requirements, the vehicle is considered to be in compliance with regard to the COP requirements of paragraph 2.4.2. If one of the test results of the second or third vehicle does not fulfil the COP requirements in paragraph 2.4.2.5. The vehicle type shall be considered not to conform to the requirements of QuietTRUCK and the participant shall take the necessary measures to re-establish

the conformity.

2.4.2.6 Retains to withdraw

Cemafroid retains the right to withdraw PEAK type-approval certification until a participant can prove that their products are in conformity with PEAK demands.

2.5 Continuing conformity during the product's use phase

During the design and production phase, the participant will do everything within their power to ensure that the product's noise emissions, during normal usage, will in the long run continue to meet the requirements in this PEAK protocol. This includes, but is not limited to, preventing corrosion, the sustainable mounting of noise reducing measures and the prevention of wear and tear.

2.6 Procedure for applying for certification

In the document 'Set-up and working method' of Cemafroid the process for applying for a type-approval certificate and the stickerregistration is described. The paragraphs below provide a brief summary of this document. See also annex B Definitions of tasks and roles for some explatiation.

2.6.1 PEAK type-approval certification

When applying for a Peak or QuietTRUCK type-approval certificate the participant shall sent also a testreport to schting Peak. This testreport shall fullfill the meets the requirements described in this document. For receiving the type-approval certificate and the right to apply PEAK stickers to their product, the participant will be asked to sign a declaration.

2.6.2 Stickerregistration

In the database of Cemafroid every individual vehicle shall be registered.

- With every individual sticker request in the databae of Cemafroid, the participant shall refer to the initial Product family report, family definition approval and type-approval certificate which they believe is applicable to the individual vehicle in question.
- By referring to a particular report, the family definition approval and type-approval certificate the participant declare that the product in question meets the characteristics included in that report;
- The participant states – by means of selecting the disclaimer for the product in question – that the product being entered into the database of Cemafroidas part of the administrative process for allocating a sticker also meets the characteristics in that report, family definition spproval and type-approval certificate to the maximum extent possible. The participant accepts all possible (financial) consequences and indemnifies the Stichting for all liabilities resulting from any party if it becomes apparent that this is not the case;
- The Stichting should be provided with the opportunity to carry out spot checks on Peak approved products except of QuietTRUCK. QuietTRUCK are monitored through COP testing according to 2.4.2.5. The participant accepts the risk that failing this type of test may result in

a fine or in other appropriate measures such as: a warning, a temporary suspension of the certification's validity for a Product family or the permanent withdrawal of certification.

2.7 Transitional provisions

As from 1 May 2024, Cemafroid will not issue Peak type-approval certificates if the sound measurements, testreport and additional documents do not meet the demands in the test protocol entitled "Measurement methods for PEAK noise during loading and unloading (2024 update)".
From the moment of publication of the 'Measurement methods for PEAK noise during loading and unloading (2024 update)' Peak and QuietTRUCK type-approval certificates based on the update 2024 can be requested. For the request of a QuietTRUCK type-approval certification based on the Peak Measurement methods for PEAK noise during loading and unloading (2018 update) is allowed to use until 1 May 2025.

For QuietTRUCK the next Transitional provisions are valid:

		2024-01-01 until 2027-04-30	2027-05-01 until 2029-04-30	From 2029-05-01
Driveline Noise	New Types and/or Renewal of Certificate	72		
	New registrations (based on type-approval)	72		
Air Release noise	New Types and/or Renewal of Certificate	72	67	
	New registrations (based on type-approval)	72		67
Door closing	New Types and/or Renewal of Certificate	-*	67	
	New registrations (based on type-approval)	-		67
Reversing alarm system	New Types and/or Renewal of Certificate	Method A or B: 62	Method B: 62	
	New registrations (based on type-approval)	Method A or B: 62		Method B: 62

*Test results shall to be reported, but does not need to meet the limit values included in paragraph

2.1 (informative).

3. Measuring equipment, general measuring conditions and procedure

The requirements made on the equipment, acoustic environment, meteorological conditions and background level mostly reflect those included in UN/ECE regulation R51 Annex 3 [3]. The following deviations and additions apply:

3.1 Measuring equipment

The required measurement equipment shall comply to the following specifications to perform PEAK measurements:

- Sound level meter, type 1 (in conformity with "IEC 61672-1:2013: Sound Level Meters", equipped with an A filter, "Fast" adjustable integration time and read-out option set to "Max. Hold" or an equivalent data acquisition system (to be proven using certificates)
- Windshield for microphone
- Acoustic source type 1 (in accordance with IEC 60942:2017, Sound calibrator) to calibrate the sound level meter
- Speedometer, accuracy +/- 1 km/h
- Revolution counter, accuracy +/- 3%

The sound level meter and the acoustic source shall be calibrated by a certified institution at least once every two years. The necessary certificates for the measuring equipment used shall be submitted to Cemafroid upon request.

3.2 Measuring conditions

During measuring, the background noise level ($L_{pA,\ max}$) should be at least 10 dB(A) lower than the noise level produced by the source/activity being assessed. Ideally, the background noise level in area should be lower than 45 dB(A). The background noise level is the maximum noise level $L_{pA,max}$ resulting from external sources during the execution of a PEAK sound measurement. The amount of background noise level shall be determined by measuring the maximum noise level $L_{pA,\ max}$ resulting from external sources for a period of 10 seconds. The background noise level shall be determined at the start of the measurement. It is recommended that the test site provides stable background noise for at least period of 1 minute, to ensure sound recording to not be contaminated. This background noise level shall be recorded. No corrections are to be carried out due to eventual contributions from background noise.
The current wind speed (at the measurement height) may not exceed 5.0 m/s during the sound measurement interval.
Sound measurements should be carried out when it is dry. The air temperature should be between 5.0 and 40.0°C.

There should not be any reflecting outer walls or objects within a radius of 25m from the object to be measured or the microphone(s). There should not be any objects or person between the target object and the microphone.

Ideally, measurements should be executed in a testing area and on a surface which meets the requirements in ISO 10844:2021 and certified. In case of a stationairy test the target object shall be positioneded such that the surface under the microphone and under the target object and between the target object and microphone(s), as well as within a radius of at least 1 metre surrounding that area shall be smooth and 'acoustically' hard.

However, to ensure that the methods of measurement remain accessible to smaller manufacturers, acoustically comparable testing areas may be used, like a car park, as long as they meet the following qualifications:

- This testing area is large enough to accommodate the prescribed actions and/or movements the target object needs to perform as well as being large enough to accommodate microphone(s) at the prescribed distance.
  - The surface under the microphone(s) and under the target object and between the (moving) target objects and microphone(s), as well as within a radius of at least 1 metre surrounding that area shall be smooth and 'acoustically' hard. In figure 3.1 and 3.2 examples are given of the minimum 'acoustically' hard surface when the testloaction is does not have an ISO 10844:2021 certification. In the figures about the measurement setup in the chapters 4-10 the minimum 'acoustically' hard surface is also indicated.
  - 'Acoustically hard' is understood to mean an absorption coefficient of ≤ 10% in the frequency range of 315 up to and including 1600 Hz.
    - Surfaces that meet this requirements: a flat closed surface consisting of dense concrete, dense clinkers or dense asphalt concrete are considered sufficient.
    - Other surfaces are considered insufficient.
      Surfaces that do not meet these requirements are in any case
      - (loos or pressed) sand, soil or gravel,
      - (bare or planted) ground, open or semi dense road surfaces, including porous asphalt, surfaces with vegetation.
      Surfaces that are not made entirely of acoustically hard materials are also not sufficient as are cracked and broken concrete surfaces.

  The minimum 'acoustically' hard surface shall be clean and dry and free of any snow, ice, leaves, vegetation , sand or noise scattering and/or noise absorbing substances.

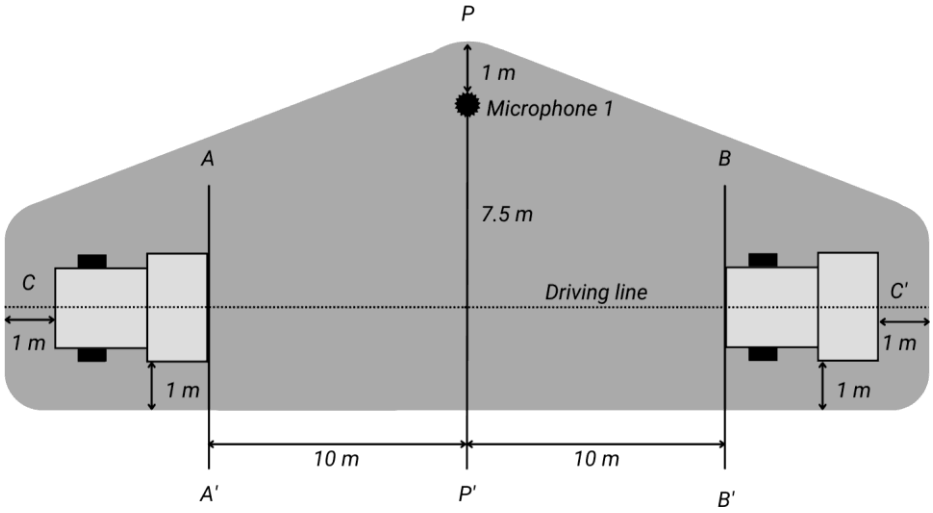

Figure 3.1: Minimum dimensions for the acoustically hard surface (e.g. to determine the pass by noise of vehicles in accordance with paragraph 4.5)

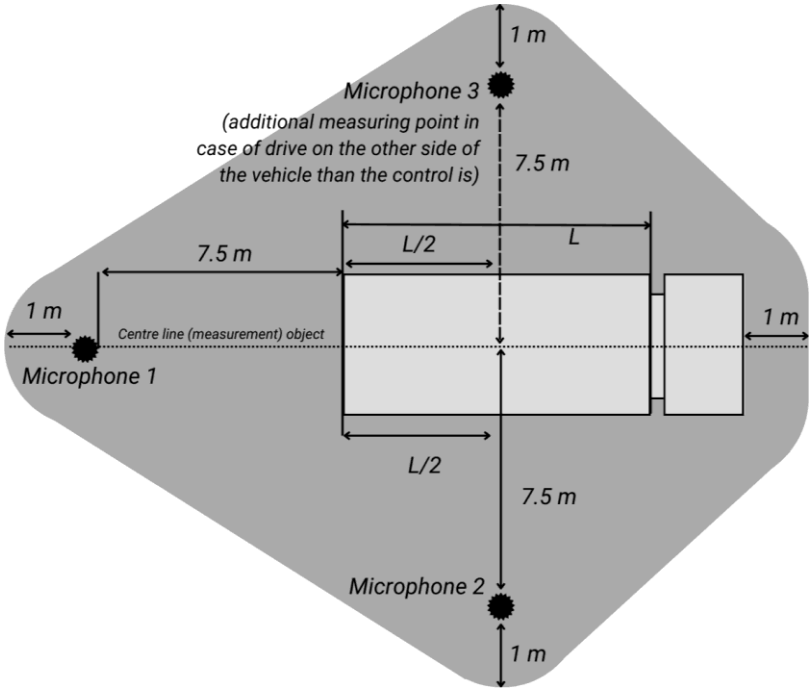

Figure 3.2: Minimum dimensions for the acoustically hard surface (e.g. to determine the sound of tail lift in accordance with paragraph 6.1). The drive system of the tail lift is located on the other side of the vehicle then the control.

Deviations can be made from the measurement conditions described. However, this is only permitted if it leads to higher noise levels. Some examples are:

- obstacles behind the target object or sound level meter if these obstacles are nearer to these

items than prescribed

- higher levels of background noise than permitted
- measurements are carried out indoors instead of outdoors
- a wet surface or a surface with a rougher finish

Deviations which may result in lower noise levels are not permitted. Examples include:

- Obstacles located between the target object and the sound level meter
- Absorbent surfaces like pervious asphalt or gravel
- A surface covered in snow, leaves etc.

All deviations from the prescribed measurement conditions shall be accurately recorded in the report in writing and with sufficient images.

3.3 Measurements

For stationary tests, the microphone is aimed at the measured object, parallel to the ground. For moving objects, the microphone is also directed perpendicular to the direction of movement. The standard measuring distance for moving test objects is 7.5m from the driving line, and for stationary set-ups 7.5m from the axis of the object to be measured, on the side of the noise source. A stationary set-up at 7.5m from the edge of the target object is required for 'some' measurements. The standard microphone height is between 1.2m ± 0.02m above the road surface.

The target object to be measured have to be placed horizontally.

All measurements (measurement distances, courses etc.) which are listed in the test protocol are subject to a standard tolerance of 1% unless otherwise stated.
All target speeds are subject to a standard tolerance of 10% with a minimum of 1 km/hunless stated otherwise. For measurements where no target speed is stated in the measurement method, such as doors of loading aerea (see paragraph 5.1) and steps (see paragraph 5.5), the measurement shall be carried out at a speed that corresponds to normal practical use.
Measurements outside the tolerance area or measurements with unexpected, non-representative noise peaks shall be discounted.
Complete working cycles are always measured at least 3 times.

In general, measurements will be taken in an unloaded condition, unless the paragraphs in question demand a loaded condition. Readings of non-representative, interrupted or erroneous measurements shall be removed. If only one microphone (sound level meter) is available, the prescribed number of actions will have to be carried out for each measuring point.
A reading of the A-weighted maximum sound level ($L_{A,max}$) will be recorded during the prescribed working cycle with the settings – 'Fast' and 'Max hold' activated – using a sound level meter or an equivalent setting on a measurement system.

The following paragraphs indicate how the sound level is specified for each type of source.
In some cases, the highest value of multiple readings will be determined and arithmetically rounded to the nearest integer number in dB(A), see table 3.1.

1st reading	2nd reading	3rd reading	4th reading	Highest value
86.3	87.6	86.8	84.5	88

Table 3.1: Example of highest value reading rounded to the nearest integer number

In other test set-ups, an energetic average sound level will be determined for a number of $L_{A,max}$ values. The energetic average of a series of *n* measured values L_1, L_2, L_3,….L_n is defined in accordance with:

$$L_{gem} = 10\lg((10^{L_1/10} + 10^{L_2/10} + \ldots + 10^{L_n/10})/n)$$

For energetic averaging over multiple measurements, only the average value is arithmetically rounded to the nearest integer number in dB(A), see table 3.2.

1st reading	2nd reading	3rd reading	4th reading	Energetic average value
86.3	87.4	86.8	84.5	86

Table 3.2: Example of energetic averaging with rounding to the nearest integer number

The number of averages varies depending on the type of measurement. The number of averages may be increased, which may result in a more stable average value. The recorded results are read off and presented with one decimal place. The mathematical results are presented with one decimal place.

The evaluation result is then presented in whole dB. Rounding to the nearest integer is done arithmetically. This means that, if the number to be rounded ends in 5 after the decimal point, it is rounded to the higher nearest integer. For example, 40.5 is rounded to 41.

4. Method of measurement for driveline noise of trucks and alarm systems

4.1 Measuring course, measuring conditions

The measuring course shall be part of a straight section of road. A microphone is placed halfway along the measuring course at 7.5m ± 0.075m in line CC' with the microphone (see figure 4.1). The sound measurements can be done with a single microphone (sound level meter), in which case the measuring course shall be driven from right to left and from left to right to measure both sides of the vehicle. One direction is deemed sufficient if two microphones (sound level meters) are available.
However, one microphone can be moved back and forth depending on local situations or the participants preferences.

At least three measurements are taken on both sides of the truck. The following measuring conditions

apply to the truck:

- The truck to be measured shall be in normal, ready to use condition.
  - If the truck is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the measurements.
  - Due to repeated noise measurements at low speed, the vehicle might get warmer than normal and engine cooling fans might engage automatically. In such cases it might be necessary to cool down the vehicle between repeated noise measurements, by driving some time at a higher speed.
  - Cabin climate control systems or air conditioning systems should be switched off during noise measurements.
- Trucks which have multiple modes (sport, eco, winter, off-road, etc.) should activate the standard mode used for driving on public roads.
- If the truck is equipped with a PEAK mode function, the tests can be performed with PEAK mode activated. This is on the condition that the driver has access to the PEAK mode switch inside the cabin or if PEAK mode is automatically activated by the vehicle itself.
- Load during sound measurements:
  - During the sound measurements the test mass m_{test} shall be 50 [kg/kW] x P_n [kW] where P_n equals the trucks maximum power output in an unlimited condition. When the weight of the truck with driver and measurement equipment does not fullfill to mtest it is required to add added load to achieve the desired test mass. However, the sum of the added load and the rear axle load in an unladen condition is limited to 75% of the technically permissible maximum laden mass allowed for the rear axle**.** The measured test mass shall be reported in the test report.
  - The tolerance for the prescribed test mass is +/- 5%.
  - The prescribed added load shall be placed as close as possible on top of the rear axle of the vehicle but not behind the rear axle. The test mass of a truck with more than two axles in the same product family shall be the same as for a two-axle vehicle. The added load may not affect the sound emission of the powertrain resulting from the vehicle, i.e. it may not be

equipped with noise absorbent and/or noise blocking surfaces. These constructions for carrying the added load and the added load may not contribute to the noise produced in any significant way, e.g. the truck should not contain any loose, rattling items.

- The presence or use of a vehicle body, articulated element or a (semi)trailer for transporting the load is not permitted unless this type of construction is standard for the truck and is covered by the "Representive vehicle scenario" definition which has been described in paragraph 2.3.2 Representative vehicle.

Given the low speed during testing, tyre noise falls outside the scope of this test. For a low and reproducible sound level during the test traction tyres, winter tyres or other tyres with a coarse tyre profile shall be excluded. Please note that the tyres shall meet the legal requirements for use on public roads.

4.2 Accelerating

The following procedure shall be completed, for the measurment setup see figure 4.1:

The 1st series of measurements (for all vehicles): accelerating and changing gears if necessary

- The length of the measuring course is 20 m (10 m before and 10 m after the microphone).
- The loaded truck at the beginning of the measurement is standing still and is located at the start of the course (before line AA') and is ready to accelerate. This means for example (if applicable):
    - With idling engine.
    - PEAK mode has been activated.
    - The brakes are on if necessary.
    - Trucks with a manual gearbox should be in the appropiate gear for driving off on a flat road taking into account the test mass of the vehicle, in normal urban driving. The engine is disengaged.
      The used starting gear shall be reported in the test report.
    - Trucks with an automatic transmission, adaptive transmissions, and transmissions with variable gear ratio tested with non-locked gear ratios should be placed in the standard mode for driving forward and automatic shifting (D/Drive).
- The truck should then accelerate as quickly as possible, at full throttle, from a stationary position.
- Acceleration will continue until one of the following situations occurs:
    - A speed of 20 km/h is reached.
    - The rear of the vehicle reaches the end of the course at line BB'.

  At that moment, the accelerator is released, the measurement is stopped and the noise levels are read.
- On the measuring course, gears may need to be shifted.
    - Trucks with an automatic gearbox will shift automatically and the moment to shift gear, if relevant, may be supported by a PEAK mode.
    - Trucks with manual transmission require the driver to change gears as quickly as possible to the next higher gear, as soon as:

- the RPM A x n_{rated} , is reached. Factor A equals
- $0,68 \leq A \leq 0,76$ for category N2 trucks

- $0,83 \leq A \leq 0,91$ for category N3 trucks
- the RPM $n_{max\ reduced}$ is achieved (if the test is being carried out in PEAK mode).

After shifting gear, the driver again goes full throttle as quickly as possible to accelerate as much as possible. This procedure for accelerating and shifting gears may need to be repeated a number of times until the vehicle has reached the end of the course or achieves a speed of 20 km/h.

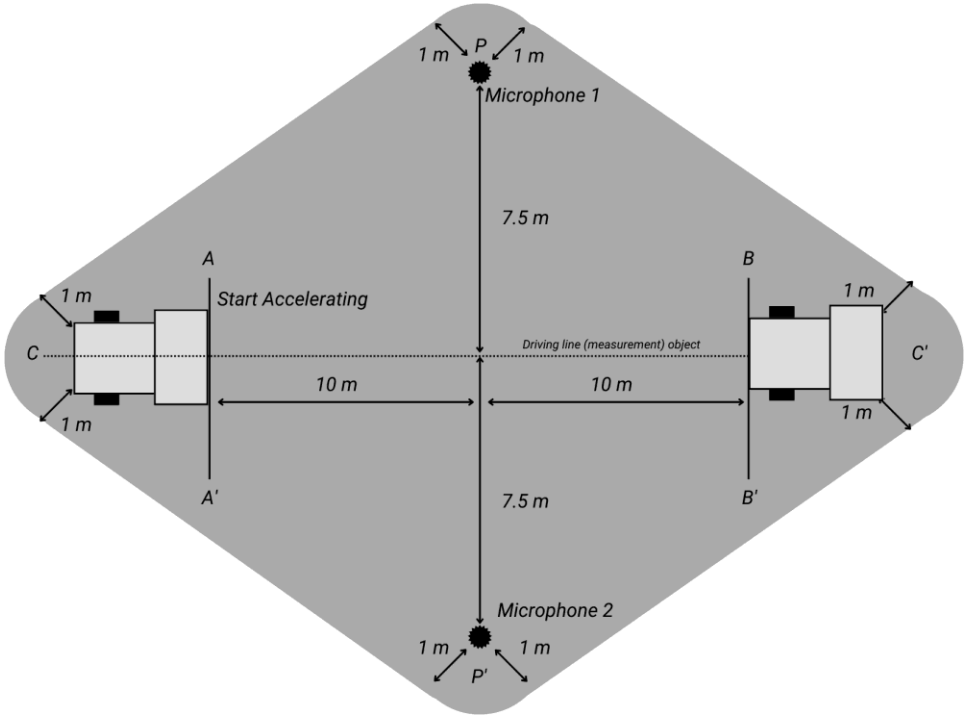

Figure 4.1: Measuring course for the acceleration test.

2nd series of measurements: accelerating without shifting gears (only applicable to vehicles with manual transmission)

- The length of the measuring course is 20 m (line AA' is located 10 m before the microphone line and line BB' is located 10m past the microphone line).
- The tested truck should drive along the driving line (line CC') in first gear with an idle speed setting. First gear is understood to mean the lowest possible gear ratio suitable for moving forwards on a flat public road while taking the vehicle's test mass into account. Special low gears for the use in terrain, manoeuvring or crawling up hill etc. should not be used (please consult the manufacturer's user manual for further information about normal usage).
- The accelerator is pressed down as hard as possible when the start of the measuring course (line AA') is reached.
- The accelerator is kept down until the rear of the vehicle reaches the end of the course and crosses line BB'. The accelerator is then released, the measurement is stopped and the

measurement values are read.

The measurement result is determined as follows:
The highest value from both measuring points of the 1st series of measurements is taken. The highest value from both measuring points of the 2nd series of measurements is taken. The highest value for the two runs is rounded to the nearest integer number in accordance with paragraph 3.3. This is the measurement result.

4.3 Compressed air noise

The compressed air noise for the following sources is measured in accordance with the procedures described in UN/ECE Regulation No R51-03 Annex 5 [3]

- Pressurising the compressor and blowing off the pressure regulator.
- Blowing off or decompressing the service/foot brake.
- Blowing off or decompressing the hand brake.

At least three measurements of each of the three above-mentioned blow off events are made.

During the test, the sound from parts of the truck that are not continuously making sound (such as a fan) shall be ignored.

The measurement result is determined as follows:
The highest value from both measuring points of the 3 series of measurements is taken. The maximum of these two values is rounded to the nearest integer number in accordance with paragraph 3.3. From this value, 1 dB(A) shall be deducted. This is the measurement result.

4.3.1 Alternative method for blowing off or decompressing the service/foot brake

On the request of the participant, the compressed air noise test for service/foot brakes can instead be conducted in the following way.

- The truck is driven with a constant speed of 20 km/h (step 1).
- After line AA' the service/foot brake is applied with a normal and constant force. The truck shall stop before the line BB' (step 2).
- The compressed air pressure in the brake chamber is recorded, either by manual instrumentation or by reading out from the trucks On-Board Diagnostic data. The average brake pressure from the moment the brake is applied untill the truck has stopped is the target pressure for step 4 (step 3).
- The stationary test for compressed air release due to service/foot brake decompression, as described in paragraph 4.3 is conducted, with the amount of force applied to the brake to give the target brake pressure as found in step 3 (step 4).
- The test is repeated and measured at least 3 times. The highest of the 3 measured values among these is rounded to the nearest integer number in accordance with paragraph 3.3. Because of the measurement uncertainty this rounded number is reduced with 1 dB(A). This is the measurement result.

During the test, the sound from parts of the truck that are not continuously making sound (such as the fan) is ignored.

4.4 Reversing alarm system and blind spot warning system

The measurement is only carried out if the system can be used when manoeuvring during loading and unloading. If applicable, the measurement will be carried out in PEAK mode, which automatically reduces the volume emitted by the warning signal. If the system is not present or is switched off automatically in 'PEAK mode', the measurement does not need to be taken. When the truck is equipped with an AVAS (Acoustic Vehicle Alerting System) and AVAS is on when the vehicle is stationary then AVAS is part of the reversing alarm system test.

The following procedure shall be completed for measuring the sound signal:

- Only the truck without trailer or semit-trailer will be measured.
- The truck is stationary with powertrain deactivated during the test, and the truck state is such that the relevant acoustic signalling systems are in operation.
- In case the truck is equipped with an AVAS compliant with the UN/ECE Regulation No 138, it shall not be interfered with. It shall operate as designed by the manufacturer during the reversing alarm system test as well as the turn right (blind spot) test.

The reversing alarm system and turning right (blind spot) warning system have to be tested separately. See figures 4.2 – 4.4 for the measurement setups.

4.4.1 Reversing alarm system:

During the transitional provisions period (paragraph 2.7) method A or B for the reversing alarm system can be used.

4.4.1.1 Method A:

- The sound from the reversing alarm system is measured three times at a distance of 7.5 m from the rear of the vehicle at the height of 1.2 m above the road surface (figure 4.3) (signal duration 10 s for each measuring).
- The intermediate results are the highest values from each measurement and rounded to the nearest integer in accordance with paragraph 3.3.

4.4.1.2 Method B:

The sound8 from the reversing alarm system is measured three times at a distance of 7.0m from the rear of the vehicle.

- The maximum sound pressure level shall be sought within the range of 0.5 and 1.5 m above the road surface (figure 4.4), and the height, at which the maximum sound-pressure level was found has to be fixed for the purpose of taking the measurements prescribed below.
- The sound pressure level shall be measured three times at that fixed height for a duration of at least 10 seconds.
- The intermediate results are the highest values from each measurement and rounded to the

nearest integer in accordance with paragraph 3.3.

The measurement result for reversing alarm system method A or B is the maximum value of the three intermediate results.

4.4.2 Blind spot warning system:

The noise is measured at least three times at a distance of 7.5 m from the side of the vehicle, directly across from the cabin's rear (figure 4.2) (signal duration 10 seconds).
The intermediate results are the highest values from each measurement and rounded to the nearest integer in accordance with paragraph 3.3.
The measurement result for blind spot warning system is the maximum value of the three intermediate results.

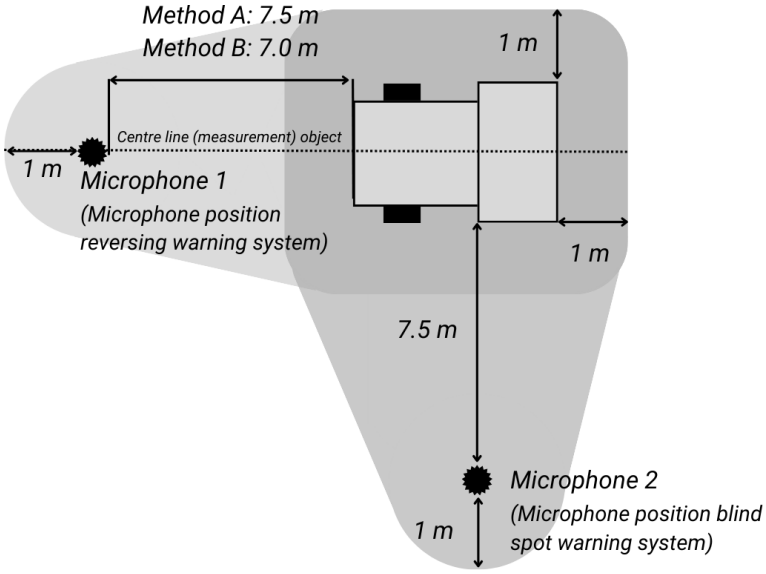

Figure 4.2: Microphone positions for measurements of reversing and blind spot warning systems

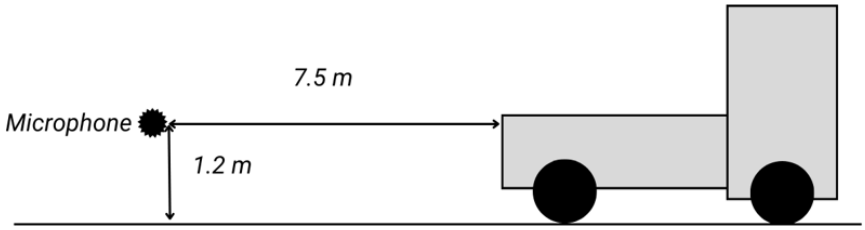

Figure 4.3: Microphone position for measurements of reversing warning system method A

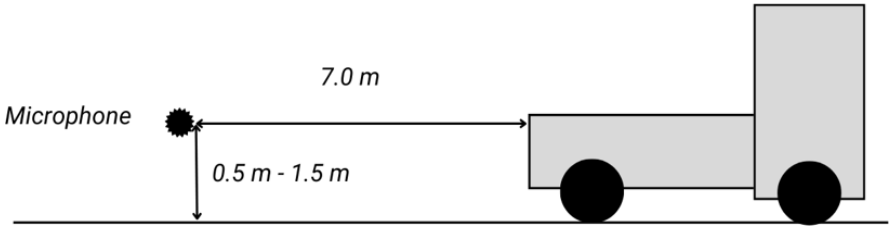

Figure 4.4: The height range of the microphone for measurements of reversing warning system method B

4.5 Pass-by sound

The pass-by sound for the trucks in motion is measured in accordance with the procedures described in UN/ECE Regulation No 51-03 Annex 3 [3].

Remarks relating to the use of UN/ECE Regulation No 51 for the certification of a QuietTRUCK:

- In deviation from parts of the text in UN/ECE Regulation No 51 dealing with “driving modes” and “urban driving”, the PEAK mode shall be activated during noise measurements (if applicable).
- RPM during the UN/ECE Regulation No 51 test: When determining the target RPM, calculations are done in accordance with UN/ECE Regulation No 51 with percentages of the RPM at maximum power output (n_{rated}). The RPM which is achieved in practice can be limited to $n_{max\ reduced}$ through intervention of the PEAK mode. The new target RPM for the UN/ECE Regulation No 51 test will now be $n_{max\ reduced}$.
- The testing area and the surface shall comply with the conditions set out in paragraph 3.2 and therefore may deviate from what has been stated in UN/ECE Regulation No 51-03 and/or ISO 10844.

5. Method of measurement for opening and closing doors of loading areas and cabins and air curtains for cargo bodies and sliding partitions, steps and strip curtains

This chapter describes the methods of measurement for several products including different variants of the doors.

For the cabin doors and the loading area doors made by the truck manufacturer, the measurement methods (paragraph 5.2) and limits (see paragraph 2.1) are different from those of the other doors made by the vehicle body builder (paragraph 5.1).

5.1 Vehicle loading area doors, hatches and hinged doors and air curtains of cargo bodies

5.1.1 Measuring arrangement

The methods of measurement for the loading area doors that are described below do not apply on doors made by the truck manufacturer.

The following set-up is used for this method of measurement (see figure 5.1):

- The engine and any other noise sources of the vehicle are switched off.
- If there is a tail lift present, it is in the lowest position on the ground or folded under the vehicle. In the case of a measurement on a top hatche the tail lift is to be aligned with the cargo floor.
- The measuring microphone is at a distance of 7.5m from the vehicle's edge opposite the center of the vehicle door or air curtain to be measured (hatch or door).
  The microphone is 1.2m above the road surface.

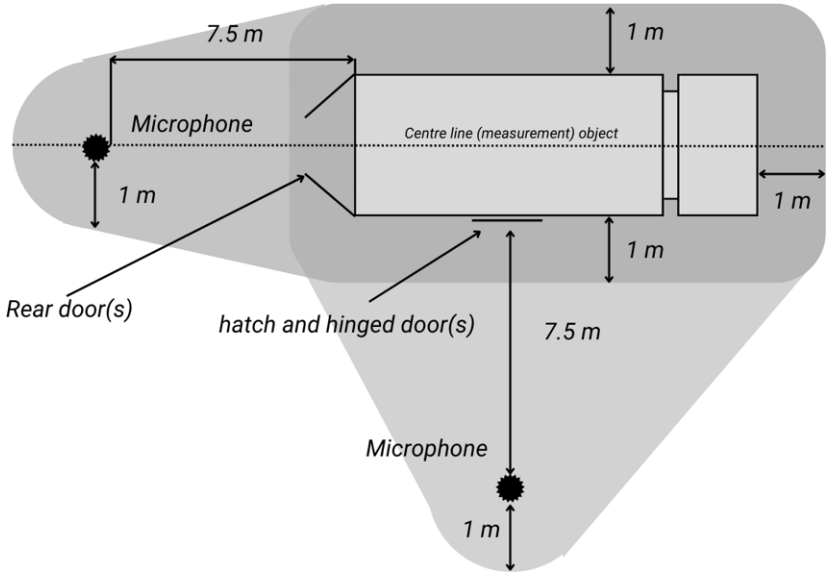

Figure 5.1 Microphone positions for measuring the noise of loading area doors, hinged, steps and air curtains for loading areas

5.1.2 Method of measurement

The following procedure shall be completed:

- The vehicle door (hatch or hinged door) is opened and closed by standing at arm's length from the vehicle door (hatch or hinged door) and grasping the door handle with an outstretched arm. A raised platform may be necessary to be able to operate the vehicle door (hatch or hinged door). The door is then opened until the handle is next to one's shoulder. If a door holder is present, the door shall be fully opened and secured with the door holder. The vehicle door (hatch or hinged door) is then closed with a single uniform motion.
- For hinged doors to the loading area, both doors are opened and closed in 1 cycle.
- For a roller door, the operator walks along in the direction of the door so that the complete motion of unlocking and sliding and relocking can be carried out
- The opening and closing of the vehicle door (hatch or hinged door) is repeated at least 5 times, waiting 5 seconds after closing each time before reading the noise level
- For air curtains, the doors of the cargo body are fully opened and the air curtain fans are turned to maximum power. Measurements are taken three times at a distance of 7.5m from the rear of the vehicle (at least 10 seconds between the measurements)

The energetic average value of the measured levels is rounded to the nearest integer number in accordance with paragraph 3.3. The rounded number is the measured value.

5.2 Cabin doors

The noise level of closing the cabin door(s) shall be measured at a prescribed speed. This speed is determined using the procedure described in paragraph 5.2.1. The method for measuring the noise level is described in section 5.2.2.

For a cabin which has different doors on the right and the left, both doors have to be measured individually. For a cabin which has identical doors on both the left and the right only the door on the driver's side has to be measured.

5.2.1 Minimum Door closing speed

- The minimum speed required for the door to be fully closed shall be determined by using any of the methods described in 5.2.1.1 or 5.2.1.2.
- At least five successfull door closing events shall be conducted and measured. The lowest speed of these is the minimun door closing speed.
- The hand shall release the door handle before the door is closed.

5.2.1.1 Automatic measurement of the door closing speed

- A special measuring device capable of measuring door closing speed may be used.
- The measuring device shall not interfere with the door closing.
- The measuring device shall be positioned to measure the speed between the tip of the door and the door frame, and positioned at a point between 0 to 15,0 cm before the door is closed.

5.2.1.2 Manual measurement of the door closing speed

- The door closing speed *v* can be estimated by recording and measuring the time *t* and the distance *s* between two known sound peaks created during the door closing procedure.
- The first sound peak can be the sound produced when the door passes by and hit a certain object. This object can be a bell, a sheet of metal or any other object that provides a clearly recognizable sound in the sound recording. The object shall be placed at a distance *d* between the tip of the door and the door frame. The distance *d* shall be above 5,0 cm and below 15,0 cm.
- The object shall not interfere the door closing movement.
- The second sound peak comes from when the door is completely closed.
- The closing speed *v* is given by: $v = d/t$.
- A data acquisition device with a time resolution of maximum 0,01 second shall be used.

5.2.2 Measurement of door closing sound

The sound level of the cabin doors closing shall be measured at a prescribed target closing speed.

- The target closing speed shall be 25 % above the minimum closing speed found in paragraph 5.2.1.
- During the test, the door closing speed shall be measured according to either of the methods described in the paragraphs 5.2.1.1 or 5.2.1.2.
- The test shall be repeated multiple times until 5 tests are within +/-15 % of the target closing speed. The average of the closing speeds of these tests shall be within ± 5 % of the target closing speed. If the average of the closing speeds of these 5 measurements is not within this tolerance band, additional tests shall be performed until 5 tests are on average within the ± 5 % of the target closing speed.

The measurement result is the arithmetic average value of the readings (minimum of 5), rounded to a intenger in accordance with paragraph 3.3.

The measuring microphone is at a distance of 7.5m from the vehicle's edge opposite the centre of the cabin door or the loading area door made by the truck manufacturer to be measured, (see figure 5.2). The microphone is 1.2m above the road surface.

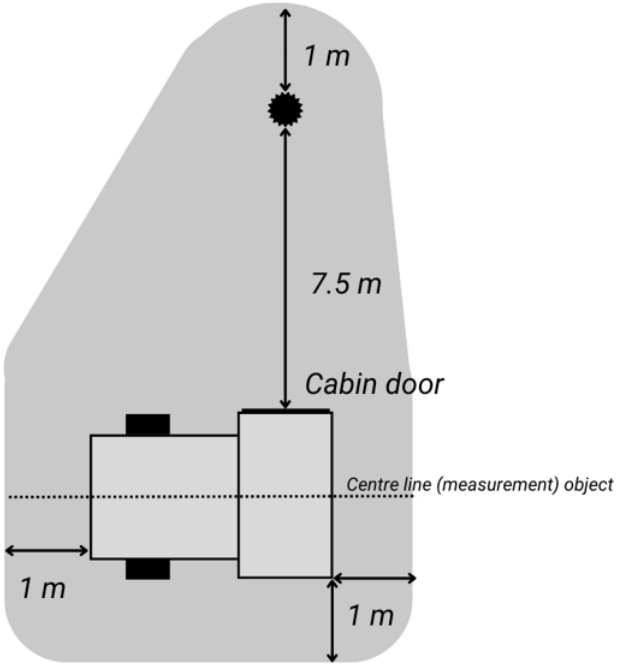

Figure 5.2 Microphone positions for measuring the noise of cabin doors and other doors made by the truck manufacturer

5.3 Roller doors and sliding panels

In addition to hatches and hinged doors, the cargo body area may also be closed by means of roller doors and sliding panels. If there are several roller doors or sliding panels, these shall be tested separately. Noise during opening and closing is evaluated as follows:

- The roller door or sliding panel is unlocked, fully opened, secured and then closed and locked again at a speed that is in line with practice.
- Sliding panels are slid completely open and then closed and locked again at a common operating speed.

See figure 5.3 for the microphone positions. If the roller door or sliding panel is mounted on the side of the vehicle, the microphone 2 is located on the side of the vehicle where the actions take place. If the roller door or sliding panel is mounted to the rear, microphone 2 is located on the side where the drive system is located. The cycle is repeated and measured at least 5 times.
If there is a tail lift present, the tail lift is in the lowest position on the ground or folded under the vehicle.

The measurement result is the energetic average value of the readings (minimum of 5 per measuring point) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

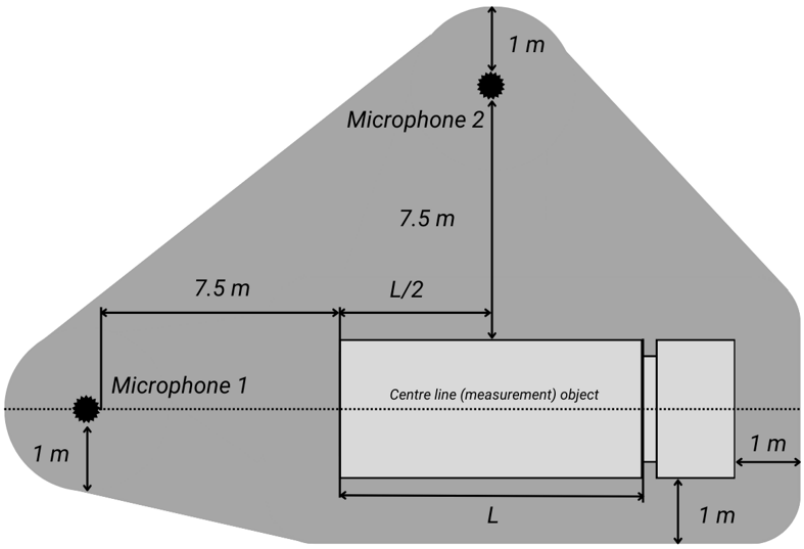

Figure 5.3 *Microphone positions for measuring the sound of* roller doors and sliding panels

5.4 Sliding partition wall

A sliding partition wall may be present in the cargo body. This kind of partition allows the cargo body to be divided into two paragraphs, so that cargo can be transported at two different temperatures. See figure 5.4 for the measurement setup

The measuring methods of the sliding partition wall are:

5.4.1 Moving

The noise produced while moving it is measured as follows:

- At the start of the cycle, the partition is located against the ceiling at the rear opening of the cargo body without being locked. After putting the partition into the correct position, it is moved to the front of the vehicle at a speed of 3 km/h. At the front, the partition is moved towards the ceiling without locking it to the ceiling. Here the tester waits for a few seconds, after which the partition is moved back to the rear of the vehicle and then moved towards the ceiling without locking it to the ceiling.
- The partition is slid against the stops both at the start of the rail and at the end of the rail.
- The cycle of moving the partition to the front and back is performed 3 times.
- The measurement result is the energetic average value of the readings (minimum of 3 per measuring point) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.
- See figure 5.4 for the measurement setup.
  The tail lift, if present, may be at loading floor height during the measurement if this is necessary for the safety of the operator.

5.4.2 Unlocking and locking

The noise produced during unlocking and locking is measured as follows:

- The following cycle is performed: The sliding partition wall is locked to the ceiling, then unlocked, and the partition is then moved to the position on the floor and locked in place. The partition is

then unlocked again and moved towards the ceiling, where it is locked.

- For each locking point, the cycle is performed at least 3 times.
- The unlocking and locking of the partition on the floor is performed at a distance of ¼L, ½L and ¾L from the rear opening of the cargo body. If the moving rail in the vehicle is shorter such thatthese distances cannot be reached, the points closest to these shall be used.
- The measurement result is determined as follows: the energetic average of 3 readings is calculated for each measuring point and collision point. The measurement result is the highest of the 6 energetic average values of the readings, rounded to the nearest integer number in accordance with paragraph 3.3.

If there is a tail lift present it is in the lowest position on the ground or folded under the vehicle. See figure 5.4 for the measurement setup.

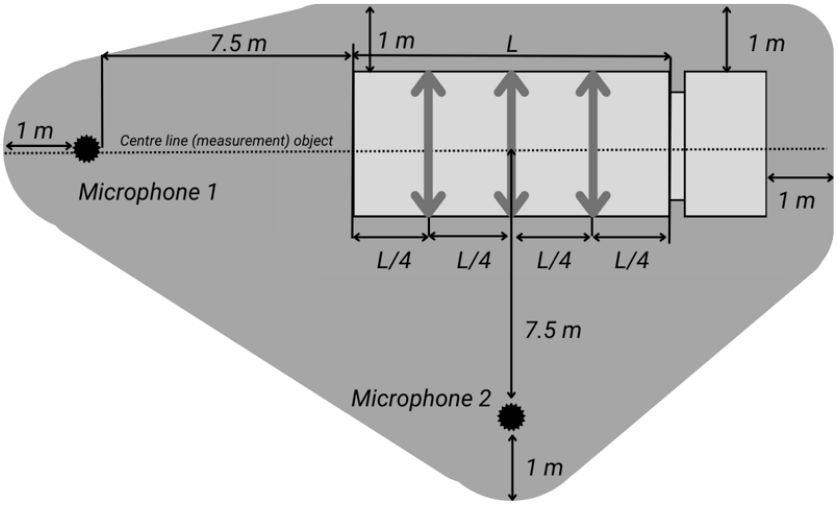

Figure 5.4 Microphone positions for measuring the sound of sliding partition wall

5.5 Steps

In order to enter the cargo body, certain vehicles are equipped with steps.

The noise produced while lowering and lifting the steps is measured as follows:

- The measuring microphone is at a distance of 7.5m opposite the centre of the steps to be measured. The microphone is 1.2m above the road surface. See figure 5.1.
- If there is a tail lift present it is in the lowest position on the ground or folded under the vehicle.
- The steps are in the transport position, the door(s) close the step are completely opend.
  The steps shall be pulled out and brought into use condition at a speed consistent with normal practical use. The step iks then brought into transport position at a speed consistent with normal practical use. A pause of several seconds is added being bringing the steps in the operating position and being placed in the transport position. Lowering and lifting the steps is one cycle.
- The above cycle is performed at least 5 times. Between the measurements, a pause of about 5 seconds shall be added to read the noise level.

- The energetic average value of the measured levels is rounded to the nearest integer number in accordance with paragraph 3.3. The rounded number is the measured value.

5.6 Strip curtain

Apart from having an air curtain, a cargo body can also be closed off by a strip curtain.

Measurement setup strip curtain

Two microphones are placed around the vehicle, with its engine switched off (see figure 5.5):

- One at 7.5m from the rear, on the axis of the vehicle.
- One at the side of the vehicle, 7.5m from the axis and at the halfway point of the cargo body length (L/2).
- The microphones are 1.2m above the paved surface.

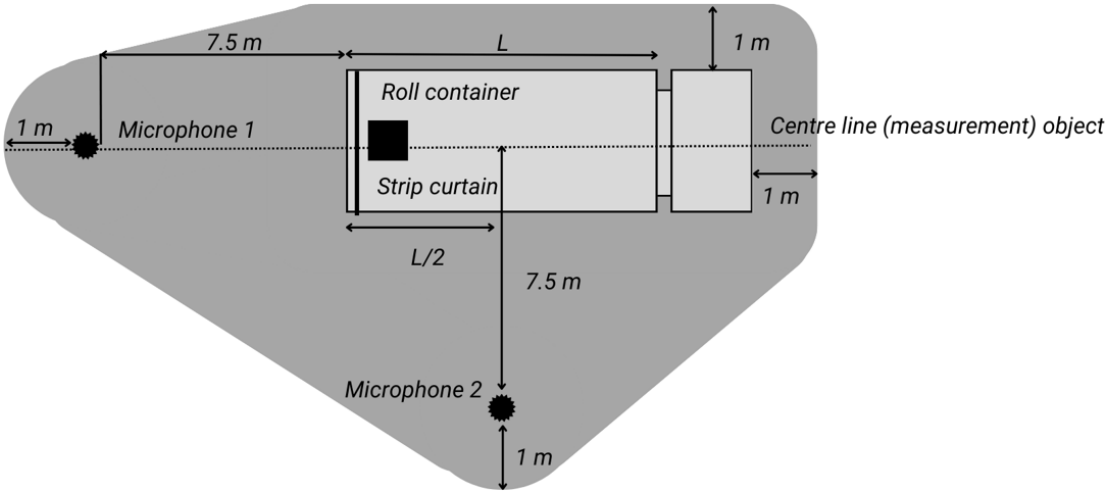

Figure 5.5 measurement setup strip curtain

The measuring methods of the strip curtain are:

5.6.1 Sliding

This can be a sliding strip curtain (perpendicular to the direction of travel) or a fixed curtain. In case of a sliding curtain, the sliding should be measured as follows:

- The doors to the cargo body in front of the strip curtain are fully open.
- If there is a tail lift present it is in the lowest position on the ground or folded under the vehicle.
- During the measurement, the strip curtain shall be moved from being fully closed to being fully open and back, and locked in place if possible. A pause of several seconds is added between fully open to closing. If the curtain consists of several sections, all the sections shall be tested
- If various types of strip curtains are present in the vehicle (opening to the right, opening to the left, opening in the middle, etc.), these shall be tested separately.
- The above cycle is performed at least 5 times. Between the measurements, a pause of about 5 seconds shall be added to read the noise level.
- The energetic average value of the measured levels is rounded to the nearest integer number in

accordance with paragraph 3.3. The rounded number is the measured value.

See figure 5.5 for the measurement setup.

5.6.2 Moving in direction of travel

The sound produced while moving it in the direction of travel is measured as follows:

- At the start of the cycle, the strip curtain is located at the furthest position at the rear opening of the cargo body and locked in place.
- Afther the start of the measurement the strip curtain is unlocked and moved as far as possible into the vehicle at a speed of 3 km/h. At the front, the strip curtain is locked in place. Following this, the tester waits a few seconds, after which the curtain is unlocked and moved back at a speed of 3 km/h to the rear of the vehicle and locked.
- The curtain is slid against the stops both at the start of the rail and at the end of the rail.
- The cycle of moving the curtain to the front and back is performed 3 times.
- The tail lift, if present, may be at loading floor height during the measurement if this is necessary for the safety of the operator.
- The measurement result is the energetic average value of the readings (minimum of 3 per measuring point) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

See figure 5.5 for the measurement setup.

5.6.3 Collision with the strips

Moving the strips of the strip curtain in lateral direction is measured as follows:

- The doors to the cargo body in front of the strip curtain are fully open.
- If there is a tail lift present, it is in the lowest position on the ground or folded under the vehicle.
- A roll container with a steel superstructure (comparable to figure 5.7) with a minimum height of 1.5m is positioned on the centre line of the vehicle in the cargo body against the strip curtain.
- The centre strip is grabbed at a height of 1.5 m, pulled back 50 cm and then released, see figure 5.6.
- The tester waits a few seconds between the strip movements to read the noise level.
- The above cycle is repeated at least 3 times.
- The measurement result is the energetic average value of the readings (minimum of 3 per measuring point) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

See figure 5.5 for the measurement setup.

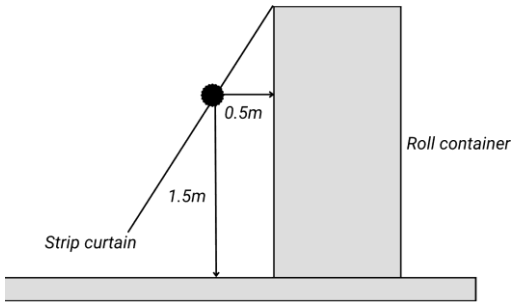

Figure 5.6 Measurment set up for the stips

Figure 5.7 Example of roll container for testing the strips

6. Methods of measurement for the tail lift and walls of vehicles and lashing devices

This paragraph deals with the methods of measurement regarding the use of the tail lift, fastening the load and moving transport equipment over the tail lift, floor and walls of the cargo body. All tests described in this paragraph are conducted with an empty cargo body.

6.1 Measuring arrangement

Two microphones are placed around the vehicle, with its engine switched off (see figure 6.1):

- One at 7.5m from the rear, on the axis of the vehicle.
- One at the side of the vehicle (tail lift operation side), 7.5 m from the axis and at the halfway point of the cargo body length (L/2).
- The microphones are 1.2 m above the paved surface.
- If the drive system is located on the other side of the vehicle than the controls, a extra measuring point is selected on that side as well and a measurement taken.

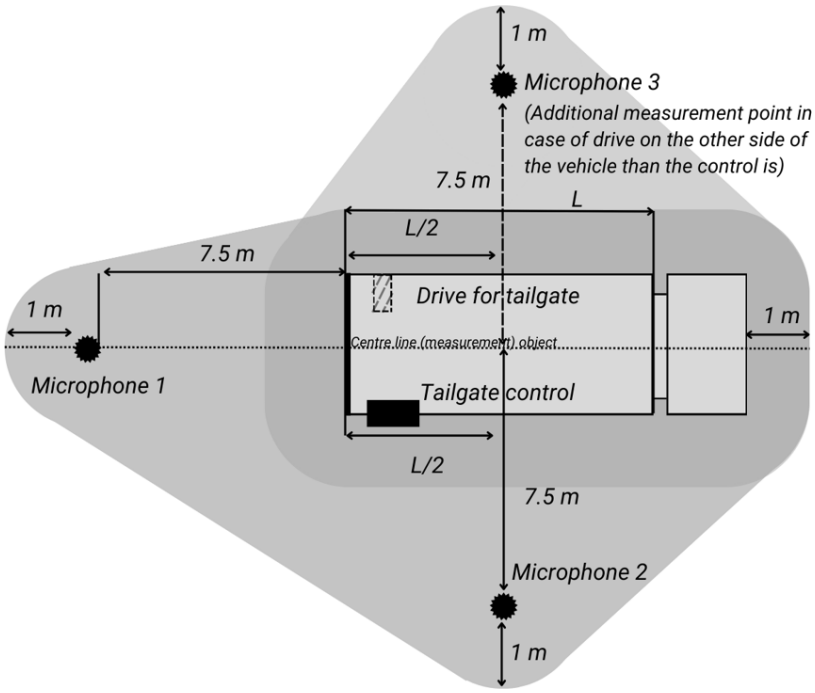

Figure 6.1 Microphone positions for measurements on the tail lift, cargo body and lashing devices

Tail lift measurement on a test setup

In addition to a noise measurement of a tailgate mounted on a vehicle, it is also permitted for the tail lift to be mounted on a test setup during the noise measurement. The test setup shall be representative of a vehicle.

- One microphone at a distance of 7.5 m from the rear, on the axis of the test setup.
- One microphone on the side of the test setup (tailgate control side), 7.5 m off-axis and opposite the center of the tailgate control.

- The microphones are 1.2 m above the pavement.
- In the event that the drive system is located on the other side of the test setup than the side where the control is mounted, a measuring point is also selected on that side of the test setup when the measurement '6.2.1 opening and closing' is carried out. This measuring point is located 7.5 m from the centre line and opposite the center of the tailbord drive system.

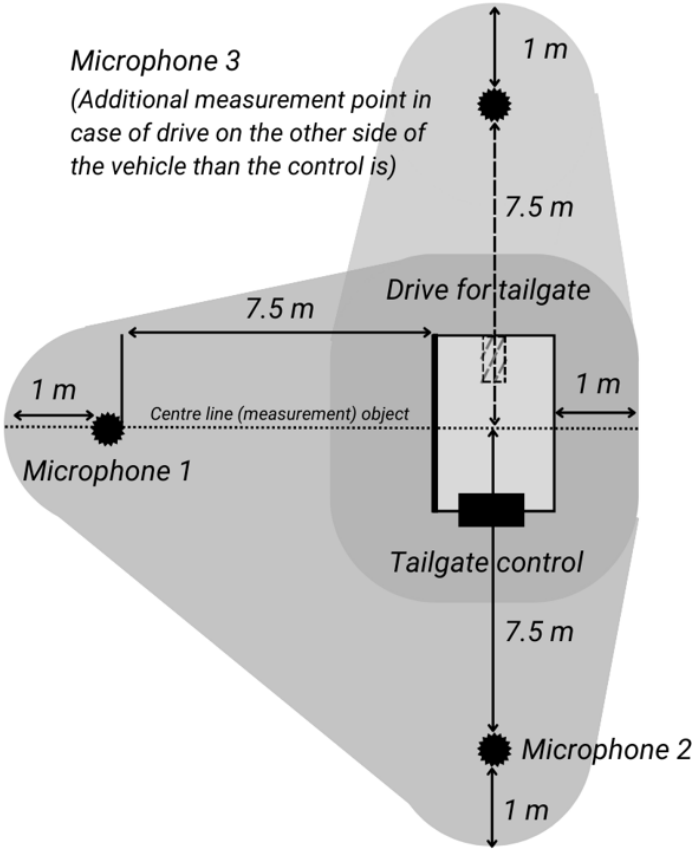

Figure 6.2 *Microphone positions for measurements near the tail lift at a testsetup*

6.2 Tail lift

The tail lift is a platform at the rear of the vehicle that can be raised. It is used to load and unload goods in roll containers or pallet trucks from the cargo body floor level to street level and vice versa. The tail lift is hydraulically driven. The hydraulic pump is electrically powered. This paragraph describes the method of measurement for the power source of the tail lift and the roll-off stops.

6.2.1 Opening and closing

The method of measurement for opening and closing the tail lift is as follows:

- See pararaph 6.1 for the measuring points.
- The noise measurement is taken during a complete cycle of opening and closing the tail lift.
- The cycle is repeated and measured three times.

- The noise measurement begins as soon as the tail lift (in the closed position) is activated, followed by the complete lowering cycle, including any folding out, until the tail lift touches the ground. The tail lift shall lie on the ground so that a roll container can be rolled onto the tail lift. The folding-up cycle then follows until the tail lift is fully folded up. The measurement is stopped.
- For each measuring point an energetic average value of the readings at the measuring points (minimum of 3 per measuring point) definid and rounded to the nearest integer number in accordance with paragraph 3.3.
- In the event that the drive system is located on the other side of the vehicle or test setup than the side where the control is mounted also from the additional measurement point shall an energetic average value of the readings at the measuring points (minimum of 3 per measuring point) be definid nd rounded to the nearest integer number in accordance with paragraph 3.3.
- The measurement result is the highest energetic average value from each measuring point.

6.2.2 Roll-off stop

The roll-off stop is a small folding barrier built into the tail lift near the rear edge of the tail lift. In its raised position, this barrier prevents a roll container from rolling off the tail lift.

The method of measurement for the roll-off stop is as follows:

- The tail lift is in its lowest position.
- See paragraph 6.1 for the measuring points. Microphone 2 is on the same side of the vehicle or test setup als the roll-off stop that is measured.
- The roll-off stop is folded down and raised at least five times using one's foot. A pause of several seconds is added between folding down and raising.
- If there are several ways to lock the stop in place, all the methods shall be tested individual.
- For each measuring point an energetic average value of the readings at the measuring points (minimum of 5 times raising and pushing down) definid and rounded to the nearest integer number in accordance with paragraph 3.3.
- If there are several ways to lock the stop in place, all the methods shall be tested. For those measurings shall be for each measuring point an energetic average value of the readings at the measuring points (minimum of 5 times raising and pushing down) definid and rounded to the nearest integer number in accordance with paragraph 3.3.
- The measurement result is the higher of the energetic average values of the readings at each measuring points, rounded to the nearest integer in accordance with paragraph 3.3.

6.3 Rolling noise

When rolling transportation equipment over a tail lift, through the cargo body or over a plate bridging a difference in height, both the transportation equipment and the plate or lift can create noise. This paragraph describes a method of measurement for evaluating only the noise radiated by the plate or lift. To obtain a collision comparable with practical conditions, a modified 'quiet' roll container is used as shown in figure 6.3. The modified roll container shall be fitted with four hard (minimum shore D 70) standard plastic wheels (no rubber tyres) with a diameter of 100 mm. The roll container is loaded with a sandbag weighing 25 kg.

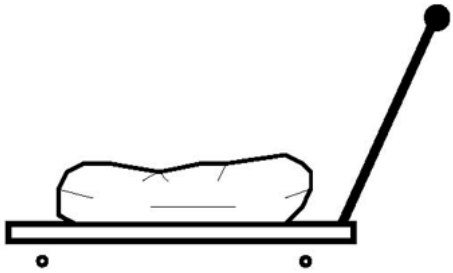

Figure 6.3: Schematic representation of a 'quiet' roll container with hard (minimum shore D 70) standard plastic wheels (no rubber tyres) with a diameter of 100 mm and a 25 kg sandbag as load.

6.3.1 Rolling over the tail lift

The method used to evaluate the noise produced in rolling over the tail lift is as follows:

- The tail lift is horizontal in its highest position, extending from the floor of the vehicle.
- The rolling speed shall be 3 km/h.
- See paragraph 6.1 for the measuring points.
- The 'quiet' roll container (see figure 6.3) is rolled at least three times from left to right and back (perpendicular to the driving direction) and at least three times from front to rear and back (in the driving direction) without rolling over the gap between the tail lift and the cargo body. (back and forth is 1 cycle).
- If the platform of the tail lift consists of several components, diverent material or surface structures, on all the components, diverent material or surface structures shall be rolled during the measuring.
- Of all the readings from both both measuring points, minimum of 6 per measuring point, the energetic average value shall be defined and rounded to the nearest integer number in accordance with paragraph 3.3.
- The measurement result is the energetic average value of the readings rounded to the nearest integer number in accordance with paragraph 3.3.

6.3.2 Rolling over the floor of the cargo body

The method used to evaluate noise production while rolling over the floor of the cargo body of the vehicle is as follows:

- The tail lift is horizontal in its highest position, extending from the floor of the vehicle or test setup.
- See paragraph 6.1 for the measuring points.
- The doors are open as wide as possible.
- The 'quiet' roll container (see figure 6.3) is rolled into the cargo body, starting at the entrance to the cargo body, to the rear panel and back.
- The rolling speed shall be 3 km/h.
- If the floor consists of several components, diverent material or surface structures over all the components, diverent material or surface structures shall be rolled.

- The measurement cycle is carried out and measured at least three times (back and forth is 1 cycle).
- There shall be no collisions with the wall while rolling.
- The measurement result is the energetic average value of the readings (minimum of 3 per measuring point) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

6.3.3 Rolling over transitions (e.g. from tail lift to cargo body floor)

The method used to evaluate the noise occurring while rolling over the gap between the tail lift and the cargo body floor is as follows:

- The 'quiet' roll container (see figure 6.3) is rolled onto and off the tail lift from the cargo body, in the driving direction of the vehicle.
- The rolling speed shall be 3 km/h.
- See paragraph 6.1 for the measuring points.
- The measurement cycle is carried out and measured at least three times (back and forth is 1 cycle).
- The measurement result is the energetic average value of the readings (minimum of 3 per measuring point) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

6.4 Noise of collision with walls of the cargo body

6.4.1 Wall

The noise radiated by the wall of the cargo body as a result of colliding roll containers, for example, is evaluated as follows:

- See figure 6.4 for the measuring points. Microphone 2 is on the same side of the vehicle as the side wall where the collision is.
- If there is a tail lift present, it is in the lowest position on the ground or folded under the vehicle.
- The collision is simulated using a ball on a cord, which is released at a distance from the side wall and then collides with the wall (see figure 6.6). By using a ball (that radiates little noise) instead of a roll container, for example, only the noise radiated from the wall is measured, in analogy with the rolling noise measurement (see paragraph 6.4). In principle, measurements are taken on one side of the vehicle only.
- A steel ball weighing 1 kg hangs on a cord. The distance from the centre of the ball to the fastening point (directly above the collision point) of the cord is 1m. The ball is released at a distance of 10 cm from the centre of the steel ball and the wall (see figure 6.4). The ball is caught after the collision. The sound level is read.
- A pause of a few seconds is added between the collisions to read the noise level.
- If there are wheel housings in the cargo body, a single collision point on the vertical wall of the wheel housing is chosen. The fastening point of the cord is kept directly above the collision point on the wheel housing. The collision is equivalent to the collision with the wall.
- The collision points are 15cm above the floor and at a distance of 1/4L, 1/2L and 3/4L from the

rear opening of the cargo body.

- For eacht collision point the measurment will be done three times.
- The measurement result is determined as follows: the energetic average of 3 readings is calculated for each measuring point and collision point. The measurement result is the highest of the 6 energetic average values of the readings, rounded to the nearest integer number in accordance with paragraph 3.3.

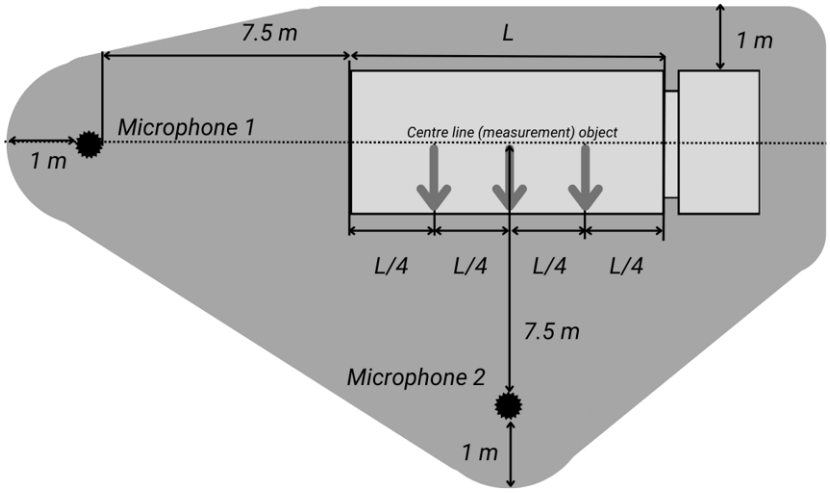

Figure 6.4 Measurement set up for measuring the lift sidewall

6.4.1.1 Additional components on the wall

Additional products, such as cargo rails, may be mounted on the wall of the loading area of vehicles. If these products protrude from the collision points at the height of 15 cm according to paragraph 6.4.1, these products shall be additionally tested.

To assess the sound radiation of these products, the procedure described in paragraph 6.4.1 shall be followed, with the addition:

- The collision points are at a distance of 1/4L, 1/2L and 3/4L from the rear opening of the cargo body on a hight that match with the center of the product. When the product is not on a distance of 1/4L, 1/2L and 3/4L from the rear opening of the cargo body then the collision points are as close as possible to these dimensions.
- A shorter lengt of the cord is allowed if, due to the position of the product on the wall, there is no space available to use a cord length of 1 m. If the length of the cord needs to be shortened, the distance from the ball to the side wall may be reduced proportionately. For example, with a cord length of 50cm, the distance from the center of the ball to the product may be 5cm.

6.4.2 Front end

- See figure 6.5 for the measuring points.
- If there is a tail lift present, it is in the lowest position on the ground or folded under the vehicle.
- A steel ball weighing 1 kg hangs on a cord. The distance from the centre of the ball to the fastening point (directly above the collision point) of the cord is 1m. The ball is released at a distance of 10cm from the front end (see figure 6.6). The ball is caught after the collision. The

noise level is read.

- A pause of a few seconds is added between the collisions to read the sound level.
- For eacht collision point the measurment will be done three times.
- The collision points are 15cm above the floor and at a distance of 1/3L from the side walls of the cargo body.
- The measurement result is determined as follows: the energetic average of 3 readings is calculated for each measuring point and collision point. The measurement result is the highest of the 4 energetic average values of the readings, rounded to the nearest integer number in accordance with paragraph 3.3.

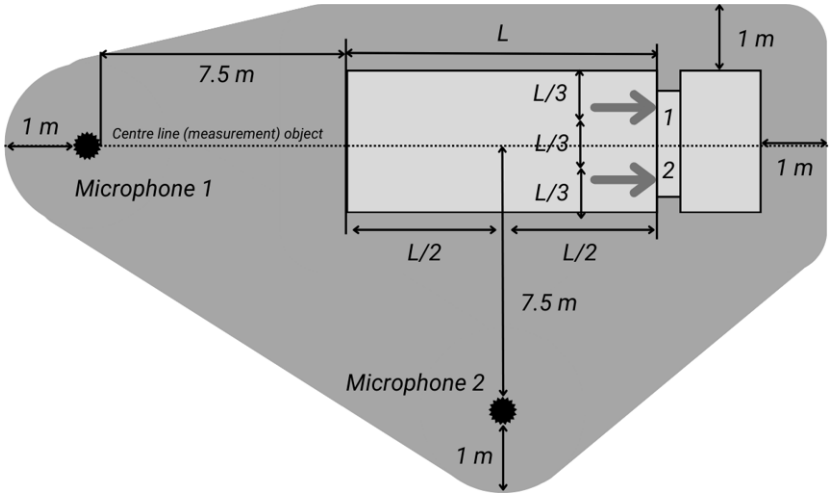

Figure 6.5 Measurement set for measuring the front end of a vehicle

6.4.2.1 Additional components on the front end

Additional products, such as transport refrigeration, may be mounted on the front end of the loading area of vehicles. If these products protrude from the collision points at a height of 15cm (paragraph 6.4.2), these products shall be additionally tested.

To assess the sound radiation of these products, the procedure described above shall be followed, with the addition:

- The collision points are at a distance of at a distance of 1/3L from the side walls of the cargo body on a hight that match with the center of the product. When the product is not on a distance of 1/3L from the side walls of the cargo body then the collision points are as close as possible to these dimensions.
- A shorter lengt of the cord is allowed if, due to the position of the product on the wall, there is no space available to use a cord length of 1m. If the length of the cord needs to be shortened, the distance from the ball to the side wall may be reduced proportionately. For example, with a cord length of 50cm, the distance from the center of the ball to the component may be 5cm.

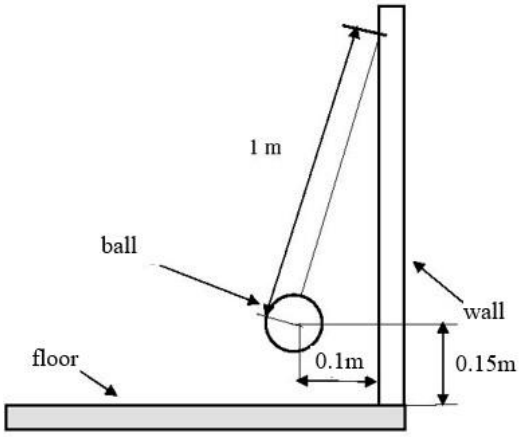

Figure 6.6 Setup from the steel ball on a cord for measuring the wall and front end

6.5 Load fastening system

Straps and clamping blocks are used to secure the load in the cargo body. Setting and releasing the load fasteners creates noise in the fastener itself and the wall, floor or ceiling of the cargo body. The following methods are intended to determine the noise resulting from securing, strapping down and collisions.

6.5.1 Straps

The method of measurement is as follows:

- See figure 6.1 for the measuring points.
- If there is a tail lift present, the tail lift is to be aligned with the cargo floor.
- A cycle consist:
    - Attach the hooks of the straps to both fastening rails of the cargo body.
    - Pull the strap on tension by pulling the strap or with the tensioner (like a ratchet) when this is part of the straps system.
    - Release the tension on the strap.
    - Remove the hooks of the straps from the fastening rails.
- This cycle is carried out at least 3 times for each point (3 times in the front, 3 in the middle and 3 in the back).
- The measurement result is determined as follows: the energetic average of 3 readings is calculated for each measuring point and fastening point. The measurement result is the highest of the 6 energetic average values of the readings at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

6.5.2 Clamping blocks placing

The method of measurement is as follows:

- See figure 6.1 for the measuring points.
- If there is a tail lift present, the tail lift is to be aligned with the cargo floor.
- Place the clamping block in both fastening rails in the cargo body.
- Click the clamping block into place. It is then released again.
- This cycle is carried out at least 3 times for each point (3 times in the front, 3 in the middle and 3

in the back).

- The measurement result is determined as follows: the energetic average of 3 readings is calculated for each measuring point and fastening point. The measurement result is the highest of the 6 energetic average values of the readings at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

6.5.3 Clamping blocks moving in hight

Some types of clamping blocks can in the fastening rails be changed in the high. When this is possible the measuring of 6.5.3 shall be preformed. When the clamping blocks can be placed in the fastening rail and changed in the high the measuring according to 6.5.2 and 6.5.3 shall be preformed.
The method of measurement is as follows:

- See figure 6.1 for the measuring points.
- If there is a tail lift present, the tail lift is to be aligned with the cargo floor.
  - The cycle starts after the clamping blocks has been placed and locked in the lowest position of the fastening railss.
  - A cycle consists of:
    - Unlock clamping blocks
    - Moves the clamping blocks at a speed that corresponds to normal practical use to the highest possible point of the fastening rails
    - Lock the clamping blocks.
    - After a few seconds, the clamping blocks is unlocked and moved to the lowest possible point of the fastening rails at a speed that corresponds to practice.
    - The clamping blocks is locked in the lowest possible point of the fastening rails.
  - This cycle is carried out at least 3 times for each point (3 times in the front, 3 in the middle and 3 in the back).
- The measurement result is determined as follows: the energetic average of 3 readings is calculated for each measuring point and fastening point. The measurement result is the highest of the 6 energetic average values of the readings at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

7. Method of measurement for shopping trolleys and pallet trucks

7.1 Rolling noise

In order to evaluate the noise of shopping trolleys, manually and electrically operated pallet trucks while rolling, a smooth surface is used with standardised irregularities applied to it. The surface itself shall not radiate noise.

The irregularities consist of steel strips, preferably glued to the surface, in accordance with figure 7.1. A different attachment method may be used, possibly combined with glue. The transport equipment is measured unloaded.

Measuring course

The measuring course for these three types of transport equipment is as follows (see figure 7.1):

- The surface shall consist of smooth asphalt or concrete.
- The irregularities consist of four rectangular metal strips 30 mm wide and 5 mm high, as indicated in figure 7.1.
- The strips are at least 1.5 times the width of the transport equipment in length.
- The strips are preferably glued or attached over the entire length of the surface.
- The four strips are applied to the measuring course in parallel at a distance of 2m from each other
- The test course is at least 1.5 times as wide as the transport equipment being evaluated.
- The length of the measuring course is 12m.

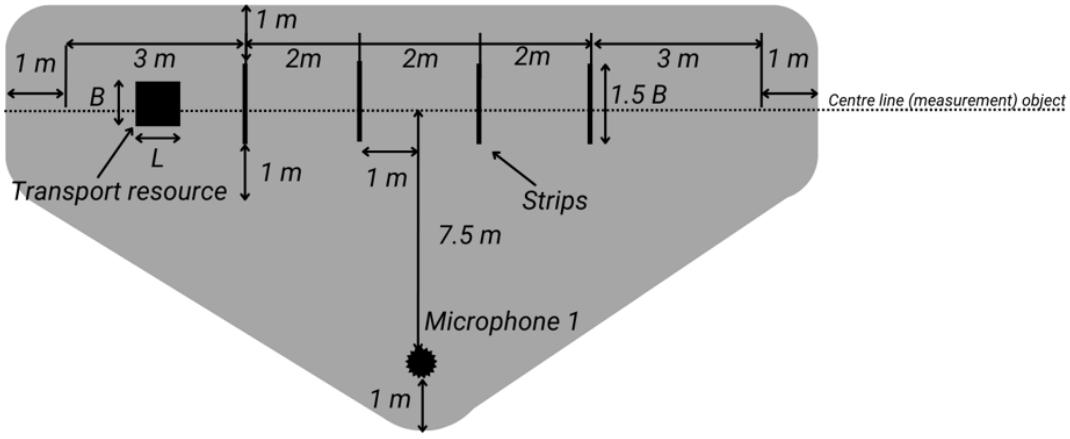

Figure 7.1: Situation for measuring the rolling noise of roll containers, pallet trucks and shopping trolleys

Measurement procedure

The measurement procedure is as follows:

- See figure 7.1 for the measuring point.
- The transport equipment is unloaded.
- When measuring the pallet truck, the fork is in its lowest position.
- The measurement consits of 2 cyclus:
  1. The transport equipment is rolled with the front (swivel castors) over the course at a walking speed of 3 km/h.

2. The transport equipment is rolled with the rear end (fixed castors) over the course at a walking speed of 3 km/h.

- All wheels shall pass over the irregularities.
- Per cyclus the measuring course is covered at least 3 times.
- For each cyclus the energetic average value of the readings (minimum of 3) at the measuring point shall be demermind, this is the intermediate results.
- The measurement result is the highst intermediate results rounded to the nearest integer number in accordance with paragraph 3.3.

7.2 Lowering and raising electrically and manually operated pallet trucks

The method of measurement applied to lowering and raising electrically and manually operated pallet trucks is the one used for evaluating the lowering and raising of a forklift truck. See paragraph 9.2 for this.

8. Method of measurement for roll containers, rollies and dollies

The roll container is a transporter for a large range of products. The roll container has a folding base and sides that can be hinged, so that the empty roll containers can be nested together for moving. The rolly (half Europallet) and the dolly (quarter Europallet) are wheeled pallets for transporting crates and boxes, and are used, among other things, for direct positioning. The empty rollies and dollies are stacked for moving around.

8.1 Rolling noise

8.1.1 Loaded

The method of measurement for rolling noise is identical to that used for shopping trolleys and pallet trucks described in paragraph 7.1, with the difference that the strips are 3mm high. The roll container and the rolly are loaded with a weight of 100kg; the dolly is loaded with a weight of 50kg. If several loading shelves can be placed in a roll container, rolly or dolly, the test shall be performed without additional loading shelves and with 75% of the maximum number of loading shelves (number shall be rounded up). When using several loading shelves, the load shall be evenly distributed with a minimum of 10kg.

8.1.2 Rolling nested roll containers

The method of measurement involves rolling three nested roll containers in accordance with the method of measurement described in paragraph 8.1.1, but unloaded.

8.1.3 Rolling empty roll containers that cannot be nested

The method of measurement for rolling noise is identical to that used for shopping trolleys and pallet trucks described in paragraph 7.1, with the difference that the strips are 3mm high. If several loading shelves can be placed in a roll container, the test shall be performed without additional loading shelves and with 75% of the maximum number of loading shelves (number shall be rounded up).

8.1.4 Rolling stacked rollies and dollies

The rollies and dollies are rolled along the measuring course in accordance with the method of measurement described in paragraph 8.1.1, with 5 stacked but unloaded rollies or dollies.

8.2 Colliding/nesting roll containers

For the collision noise, the method of measurement involves nesting the roll containers. One roll container is rolled into two already nested roll containers, as is customary with nesting.

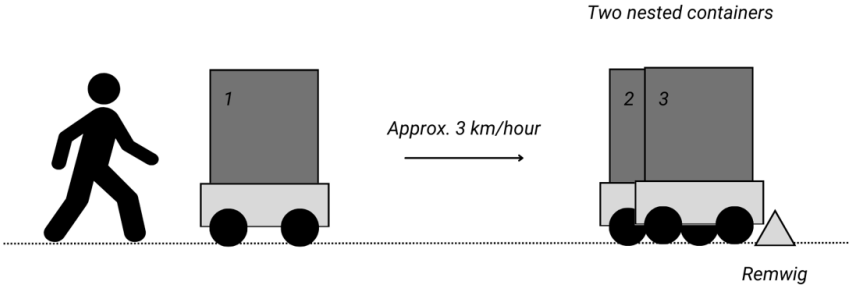

Figure 8.1 The measuring arrangement of colliding/nesting

Measurement procedure

The measurement procedure is as follows:

- Roll container 1 is pushed against the nested roll containers 2 and 3, at a speed of 3 km/h, as is customary with nesting. The two nested roll containers should be stopped by a braking chock or a similar obstacle.
- The transport equipment is unloaded and of the same type.
- The microphone is at 7.5m from the collision point on a line perpendicular to the rolling direction.
- The test is repeated at least three times.
- The measurement result is the energetic average value of the readings (minimum of 3) at the measuring point, rounded to the nearest integer number in accordance with paragraph 3.3.

8.3 Placing and removing additional loading shelves

- No additional loading shelves are present in a roll container.
- During the measurement, an additional loading shelf is placed; after placing it, the tester waits for a few seconds, after which the additional loading shelf is removed.
- The cycle is repeated at least 3 times.
- The microphone is at 7.5m from the centre point of the roll container.
- The measurement result is the energetic average value of the readings (minimum of 3) at the measuring point, rounded to the nearest integer number in accordance with paragraph 3.3.

8.4 Stacking rollies and dollies

The empty rollies and dollies are stacked for moving around.

Measurement procedure

The measurement procedure is as follows:

- The transport equipment is unloaded and of the same type.
- The microphone is placed at 7.5m from the centre point of the stationary rolly or dolly.
- An empty rolly or dolly is lifted up and placed on a stationary rolly or dolly from standing height, while measuring the noise level. The next rolly or dolly is then lifted up and placed on the two stacked rollies or dollies from standing height and the noise level is measured. Finally, one more rolly or dolly is placed on the stacked rollies or dollies and the noise level is measured.
- The measurement result is the energetic average value of the 3 measurements, rounded to the nearest integer number in accordance with paragraph 3.3.

9. Method of measurement for forklift trucks and mobile forklift trucks

A mobile forklift truck differs from other forklift trucks in that it is connected to the rear of the vehicle during transport. There are versions for which the operating personnel are not seated on the forklift but walk behind it. There are no functional differences. Like a forklift truck, a mobile forklift truck has its own drive system. Forklift trucks and mobile forklift trucks are evaluated in the same manner in terms of noise production during driving and lifting. Because of peak noise, collisions are important when driving over irregularities. A driving test is therefore proposed in which forklifts are driven over several standardised irregularities, see figure 7.1. For a mobile forklift truck, the (collision) noise that occurs when connecting it to the vehicle is also measured.

9.1 Driving

- The requirements for the measuring course and the forklift to be measured are:
- See figure 7.1 for the layout of the measuring course
- At least another 10m of smooth surface shall be available before and after the measuring course with irregularities
- The forklift is unloaded
- The forks are in their lowest position, so that the scoops of the pallet truck do not touch the strips
- The forklift is tested in its standard version as described by the manufacturer
- The engine and hydraulic system of the forklift truck shall be within the limits of the operating temperature indicated by the manufacturer.

9.1.1 Measurement procedure

The measurement procedure is as follows:

- The forklift truck is driven over the measuring course at a constant speed of 13 ± 2 km/h or, if this is not possible, the maximum speed indicated by the supplier.
- For a forklift truck with a manual gearbox, the highest gear is selected.
- For mobile forklift trucks that are operated while walking, the driving speed is 3 km/h.
- Each side of the forklift truck (left and right) is measured at least 3 times.
- The measurement result is the energetic average value of the readings (minimum of 6) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

9.2 Evaluation of lifting

Measurements are taken at 4 measuring points (front, side (2), rear) around the stationary forklift. The evaluation distance of 7.5m to the microphone is from the vertical projection of the geometric centre of the forklift to the reflecting surface.

The following measurement procedure for evaluating the lifting sound shall be completed:

- The forklift lifts a load equal to 70% of the actual capacity (permitted by the manufacturer) from minimum to maximum height at maximum acceleration
- Each side of the forklift truck is measured at least 2 times

- The measurement result is the energetic average value of the readings (minimum of 8) at the measuring points, rounded to the nearest integer number in accordance with paragraph 3.3

9.3 Evaluation of connecting mobile forklift truck

This test uses an unloaded vehicle. The doors and panels of the vehicle are closed. Measurements are taken in two directions (see figure 9.1).

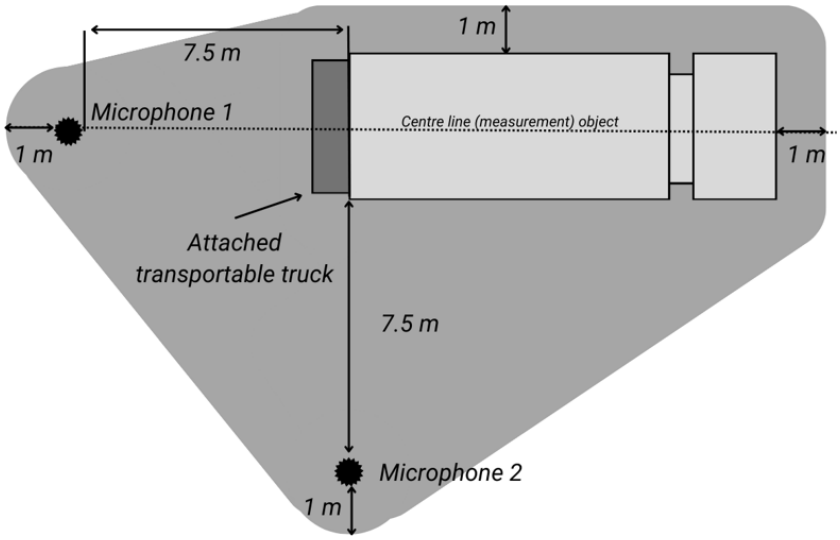

Figure 9.1: Measurement set up for measuring a mobile forklift truck

The following measurement procedure shall be completed to evaluate the noise when connecting and disconnecting the mobile forklift truck:

- The vehicle is placed in the measuring position and its engine is switched off.
- The measurement begins before the engine of the mobile forklift truck is started, on the vehicle
- The mobile forklift truck is unloaded and placed on the ground, after which it is reversed until the forklift is clear of the vehicle.
- The mobile forklift truck is then driven back into the vehicle clamp.
- The truck is put in the transport position and locked.
- The engine is switched off and the measurement stops.
- Measurements are taken at least three times. The measurement result is the energetic average value of the readings (minimum of 6) at both measuring points, rounded to the nearest integer number in accordance with paragraph 3.3.

10. Method of measurement for transport refrigeration

Refrigeration is used to keep perishable goods at the correct temperature during transport [6]. The following systems are distinguished:

10.1 Types of transport refrigeration

10.1.1 Refrigeration system with integrated combustion engine

A refrigeration system with a compressor, one or more evaporators, a control valve, a condenser and an integrated combustion engine that provides the power. The unit, possibly excluding the evaporator(s), is placed in an enclosure that is attached against the front end of the cargo body or underneath the floor. An electric motor may also be present within the enclosure to power the compressor when the trucks engine is switched off. The electric motor is then connected to the public mains.

10.1.2 Refrigeration system without separate combustion engine

A refrigeration system with a compressor, one or more evaporators (possibly in the cargo body), a control valve, a condenser. The unit is powered by the trucks engine or by a separate diesel engine mounted underneath the loading body, or the unit is connected directly to the vehicle's battery. The following are distinguished:

10.1.2.1 Electrical systems in which a generator is powered directly or indirectly by the trucks engine. For a direct drive system, the generator is powered by the trucks engine without any other components. One example of an indirect drive system is having a hydraulic transmission mounted between the trucks engine and the generator.

10.1.2.2 Systems in which the mechanical compressor of the refrigeration unit is powered directly by the trucks engine.

10.1.2.3 Electrical systems stated under 10.1.2.1 with additional support by a (quickly exchangeable) powerpack ((diesel) generator set). The latter consists of a (diesel) engine with a generator that can power the refrigeration system when the trucks engine is switched off.

10.1.2.4 Systems in which the original integrated diesel engine has been removed and mounted in a separate diesel engine enclosure underneath the cargo body.

10.1.2.5 Systems in which the unit is connected directly to the vehicle's battery.

10.1.3 Refrigeration system based on an "open" gas system

A cooling system with a control valve in which gas (e.g. nitrogen or carbon dioxide) evaporates directly in the cargo body or indirectly in one or more evaporators.

10.1.4 Refrigeration system with eutectic mass

In this system, a eutectic mass is installed in the body instead of the evaporator. The eutectic refrigerant is usually frozen when the vehicle is stationary (at night). The cooling occurs because the cooled air is heavier and floats down in the cargo body. It is also possible to use a fan in the cargo body to lead air along the eutectic mass and cool it.
This system is expected to be sufficiently quiet in terms of the PEAK noise issue and will not be discussed any further.

If the vehicle is equipped with a PEAK mode switch, the tests can also be performed with PEAK mode activated. PEAK mode shall be driver-independent. The driver shall not be able to influence PEAK mode either, see also 10.4.

10.2 Measuring arrangements

The vehicle with transport refrigeration is placed in the middle of the measuring surface.

10.2.1 Measuring points for refrigeration unit at front end

If the refrigeration unit is mounted to the front end of the vehicle, measurements are taken in 2 directions (angular width is 90°) at the front of the transport refrigeration unit in the horizontal plane at a height of 3m and at 1 measuring point above the transport refrigeration unit (see figure 10.1).

The distance from the 2 measuring points in the horizontal plane to the geometric centre of the refrigeration unit is 7.5m. By way of exception, measurements may be taken at a distance of 2m above the refrigeration unit instead of 7.5m, converting the level to 7.5m as follows:

$L_{pA\ max,\ 7.5m\ calculated} = L_{pA,\ max,\ 2m\ measured} - 11\ dB(A)$, to a noise level at a distance of 7.5m. If measurements can be taken at 7.5m above the vehicle, this will be preferable.

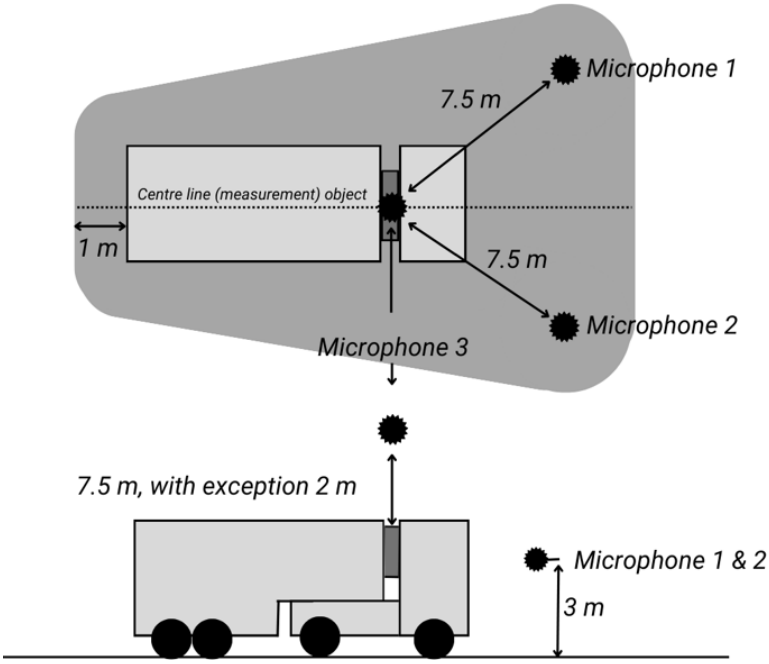

Figure 10.1 Measuring points around the transport refrigeration unit mounted to the front end

10.2.2 Measuring points for refrigeration unit underneath cargo body

If the refrigeration unit is not mounted to the front end, but underneath the cargo body, the measuring points indicated in figure 10.2 will be used rather than the measuring points indicated in figure 10.1.

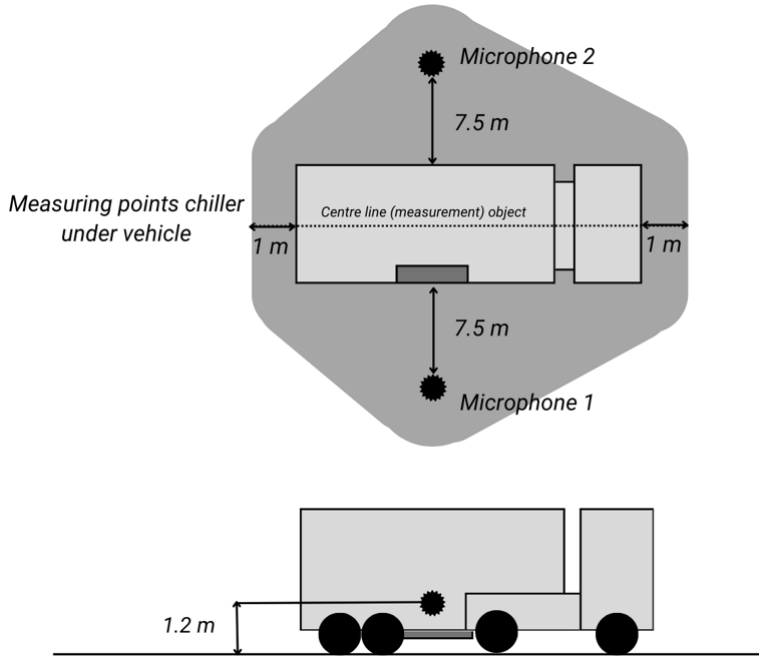

Figure 10.2 Measuring points if the refrigeration unit is mounted underneath the vehicle.

10.2.3 Additional measuring point for unit powered by trucks engine

If the trucks engine is used to power the refrigeration unit, a measuring point at a distance of 7.5m from the front of the engine compartment and at a height of 1.2m in accordance with figure 10.3will be chosen in addition to the measuring points indicated in figure 10.1 or 10.2. The entire installation shall be operational during the measurements.

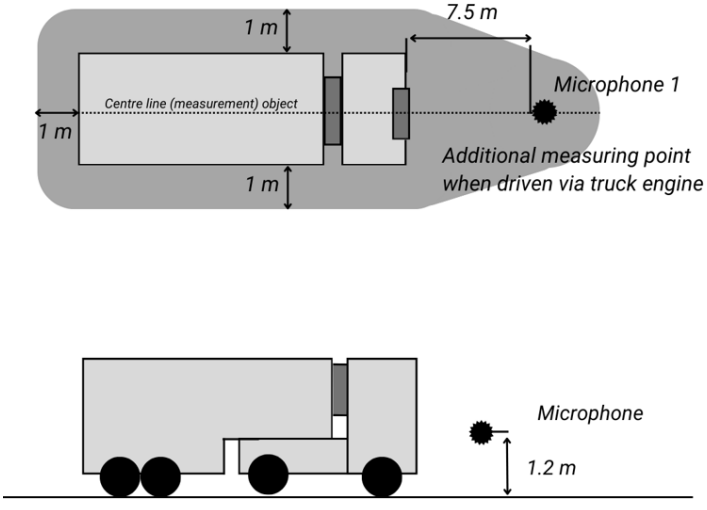

Figure 10.3: Additional measuring point for unit powered by the engine of the vehicle

10.2.4 Additional measuring points for drive system underneath cargo body

If the drive system for the refrigeration unit is mounted underneath the vehicle (10.3.4 and 10.3.5), measuring points will be selected at 7.5m from the sides of the vehicle, positioned parallel to the

centre of the drive unit (e.g. diesel engine, compressor, hydraulic motor, etc.) at a height of 1.2m in accordance with figure 10.4, in addition to the measuring points indicated in figure 10.1 or 10.2. The entire installation shall be operational during the measurements.

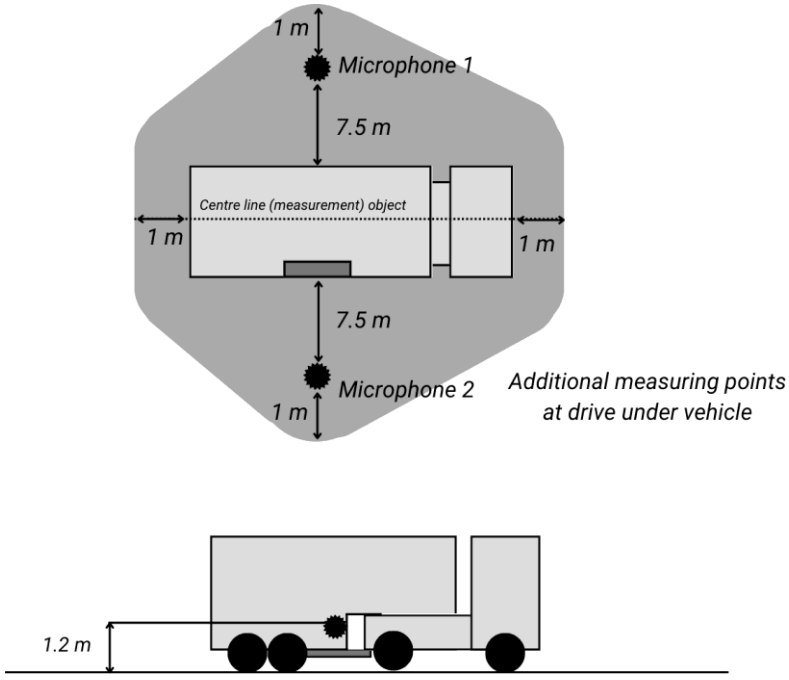

Figure 10.4 Additional measuring points for drive system underneath cargo body

10.3 Measurement procedures

There are different measurement procedures for the refrigeration systems described in 10.1. These measurement procedures are described in 10.3.

It may be possible to drive a refrigeration system in various ways, for example, using an integrated combustion engine and through a power connection with the public mains. If a refrigeration system can be driven in various ways, all the possible methods shall be tested.

Only a full system can be evaluated; individual parts such as a (quickly exchangeable) powerpack cannot be evaluated separately.

10.3.1 Evaluation of refrigeration system with integrated combustion engine (see 10.1.1 Refrigeration system with integrated combustion engine)

The following measurement procedure shall be completed:

- Position the vehicle in measuring location, switch off the engine of the truck.
- To guarantee that the refrigeration system to be measured operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the 'set' temperature at -/- 20°C. If the refrigeration system cannot be set to a 'set' temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible 'set' temperature

- Start the diesel engine of the refrigeration unit, turn the refrigeration unit on and set it to the 'diesel-high' operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions)
- Main evaporator/evaporator with greatest capacity is operational
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings)
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3

For the 'diesel-low' operating condition, the noise level is lower than for the 'diesel-high' operating condition. As the diesel engine runs at reduced RPM in the 'low' setting, this situation will therefore not be evaluated.

If the compressor can be powered by an additional electric motor (connection to the public mains), the refrigeration system will also be measured in accordance with 10.3.6.

10.3.2 Evaluation of refrigeration system without separate combustion engine (see 10.1.2.1 Refrigeration system without separate combustion engine)

The following measurement procedure shall be completed:

- Position vehicle in measuring location, leave truck engine running.
- To guarantee that the refrigeration system to be measured operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the 'set' temperature at -/- 20°C. If the refrigeration system cannot be set to a 'set' temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible 'set' temperature.
- Turn on refrigeration unit and set it to the 'fast' or 'high' operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings).
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

At the current state of the art, the noise level of the truck combustionengine will be higher than the noise level produced by the refrigeration system when performing the above measurement procedure. Until vehicles are introduced that can be used to perform the above test, the refrigeration unit may be measured using a connection to the public mains in accordance with measurement procedure 10.3.6.
If the system has an "overnight cooling system" using a power connection and an electric drive system, this system shall also be tested as stated under 10.3.6.

10.3.3 Evaluation of refrigeration system without separate combustion engine (see 10.1.2.2 Refrigeration system without separate combustion engine, with a compressor directly connected to the vehicle's engine)

The following measurement procedure shall be completed:

- Position vehicle in measuring location, leave vehicle engine running and bring it to its operating temperature.
- To guarantee that the refrigeration system to be measured operates under full load, the noise

measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the 'set' temperature at -/- 20°C. If the refrigeration system cannot be set to a 'set' temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible 'set' temperature.

- Turn on refrigeration unit and set it to the 'fast' or 'high' operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings).
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

At the current state of the art, the noise level of the truck combustion engine will be higher than the noise level produced by the refrigeration system when performing the above measurement procedure. Until vehicles are introduced that can be used to perform the above test, the refrigeration unit may be measured using a connection to the public mains in accordance with the measurement procedure below.
If the system has an "overnight cooling system" using a power connection and an electric drive system, this system shall also be tested *as stated under 10.3.6*

10.3.4 Evaluation of refrigeration system without separate combustion engine (see 10.1.2.3 Refrigeration system without separate combustion engine, with additional support by a (quickly exchangeable) powerpack)

The following measurement procedure shall be completed if the system can operate without a functioning powerpack ((diesel) generator set):

- Position vehicle in measuring location, switch off engine of the vehicle.
- Electrically connect refrigeration system to the public mains.
- To guarantee that the refrigeration system to be measured operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the 'set' temperature at -/- 20°C. If the refrigeration system cannot be set to a 'set' temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible 'set' temperature.
- Turn on refrigeration unit and set it to the 'fast' or 'high' operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings).
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

The following measurement procedure shall also be followed if the system has a functioning powerpack ((diesel) generator set):

- Position vehicle in measuring location, switch off engine of the vehicle.
- Start powerpack and set it to the 'fast' or 'high' operating condition (unit settings in accordance with the manufacturer's instructions). Run the engine until it reaches its operating temperature.
- To guarantee that the refrigeration system to be measured operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with

the ‘set’ temperature at -/- 20°C. If the refrigeration system cannot be set to a ‘set’ temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible ‘set’ temperature.

- Turn on refrigeration unit and set it to the ‘fast’ or ’high’ operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings).
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

For the ‘**slow**’ or ‘**low**’ operating condition, the noise level is lower than for the ‘**diesel-high**’ operating condition. As the diesel engine runs at reduced RPM in the ‘low’ setting, this situation will therefore not be evaluated.

10.3.5 Evaluation of refrigeration system with external combustion engine (see 10.1.2.4 Systems with the original integrated diesel engine installed externally)

The following measurement procedure shall be completed:

- Position vehicle in measuring location, switch off the engine of the vehicle.
- Start diesel engine of refrigeration unit and leave it running until it reaches its operating temperature. Turn on refrigeration unit and set it to the ‘fast’ or ’high’ operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- To guarantee that the refrigeration system to be measured operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the ‘set’ temperature at -/- 20°C. If the refrigeration system cannot be set to a ‘set’ temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible ‘set’ temperature.
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings).
- Read the maximum noise levels per measuring point during the entire cycle.

The measurement result is the highest value of the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

If the compressor can be powered by an additional electric motor (connection to the public mains), the refrigeration system will also be measured in accordance with 10.3.6.

10.3.6 Evaluation of electrically powered refrigeration system with a connection to the public mains and refrigeration system based on an “open” gas system with a connection to the public mains

The following measurement procedure shall be completed:

- Position vehicle in measuring location, switch off vehicle engine or other combustion engine.
- Electrically connect refrigeration system to the public mains.
- To guarantee that the refrigeration system to be certified operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the ‘set’ temperature at -/- 20°C. If the refrigeration system cannot be set to a ‘set’ temperature

of -/- 20°C, the refrigeration system shall be set to the lowest possible 'set' temperature.

- Turn on refrigeration unit and set it to the 'fast' or 'high' operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings).
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

10.3.7 Evaluation of electrically powered refrigeration system with a connection to the vehicle's battery and refrigeration system based on an "open" gas system with a connection to the vehicle's battery

The following measurement procedure shall be completed:

- Position vehicle in measuring location, switch off engine of the vehicle.
- To guarantee that the refrigeration system to be measured operates under full load, the noise measurement will have to be taken at a cargo body temperature of between +15°C and +5°C, with the 'set' temperature at -/- 20°C. If the refrigeration system cannot be set to a 'set' temperature of -/- 20°C, the refrigeration system shall be set to the lowest possible 'set' temperature
- Turn on refrigeration system and set it to the 'fast' or 'high' operating condition or to PEAK mode (unit settings in accordance with the manufacturer's instructions).
- Main evaporator/evaporator with greatest capacity is operational.
- Read the maximum noise levels every 10 seconds for about 30 seconds (at least 3 readings)
- The measurement result is the highest value read from the measuring points and any value corrected to a distance of 7.5m, rounded to the nearest integer number in accordance with paragraph 3.3.

If the compressor can be powered by an additional electric motor (connection to the public mains), the refrigeration system will also be measured in accordance with 10.3.6.

10.4 Refrigeration system with PEAK mode

For a refrigeration unit that is fitted with a driver-independent PEAK mode control system, it shall be demonstrated that PEAK mode functions in addition to the above methods of measurement.
PEAK mode shall ensure that the refrigeration unit meets the legal noise requirements within a distance of 300 metres from the loading/unloading location.

There are several types of driver-independent PEAK modes.
The basic principle of a PEAK mode is that it is driver-independent and that, outside of the PEAK-specified time frames and outside of the so-called PEAK locations, the machine can be set to maximum power with technical tools. In other words, PEAK mode is the normal operating setting of the machine.
In case of a defect in the technical tool or other faults relating to the functioning of PEAK mode, the machine shall operate in Pie mode.
The functioning of PEAK mode shall be guaranteed. The functioning of PEAK mode shall also be demonstrated and described in the report.

11. Reporting

The test report shall be prepared by an independent expert who performed the noise measurement or under whose auspices the noise measurement was carried out.
The test report shall contain all relevant information (in wording and pictures) about the measurement(s) carried out and the measured product(s). Test reports shall be in the Dutch language or English language. Test reports that meet the requirement can be assessed by Cemafroid. After a positive assessment, the type-approval certificate is issued.
In case of a product family the description of the product family and the justification of the tested product in combination with the product family shall be hand over to Cemafroid. For QuietTRUCK the independent expert gives an advise about the vehicle family definition and the representative vehicle.

11.1 General information

At least the following information about the measurements that shall be included in the measurement report:

Company name of the Independent expert.
Name operator/supervisor of the sound measurement. Create the name of the report.

Method of measurement

Name of the measurement protocol that is used.
Paragraph title and number of the Measurement methods for PEAK noise during loading and unloading (2024 update) and description of the preformed testmethod: (where applicable, indicate any deviations from the method and the reason for doing so). In case a measurement is exempted based on other certification (R51-03, R138 or R165 as described in 2.2.1) the relevant information from those certifications are to be included in the report.
For the reverse alarm signal measurement specify method used to determine the height at which the highest sound pressure level is being measured. Either through scanning or by measuring at fixed interval, in the later case please specify the height interval in meters.

Measuring environment

Description of the measuring location:
- Date and time of the measurements.
- Description of the weather conditions: including temperature, wind speed, rainfall.
- Distance to reflecting objects (walls, etc.).
- Distance to a not 'acoustically' hard surface.
- Surface dimensions in relation to measurement object and microphone(s).
- If indoors, dimensions and furnishings of the space.
- Description of the testing location and surroundings.
- Description of the surface of the testing location included detail picture(s) of the surface.
- Background level ($L_{pA\ max,Fast}$) in dB(A).

- Pictures of the measured object with immediate surroundings, from all sides of the measured object, figure 11.1.

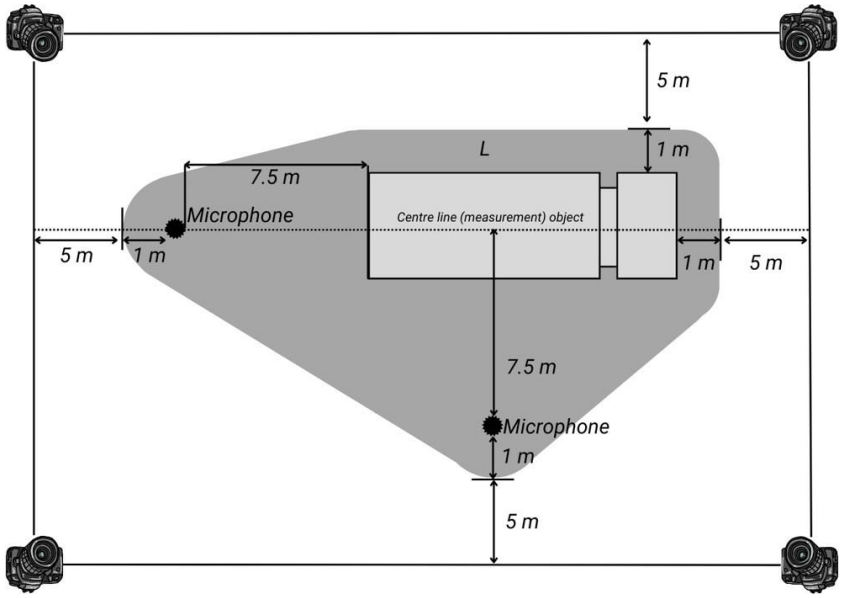

Figure 11.1 Requierd pictures of the measurment setup and location

Measuring equipment

List of measuring equipment, used, indicating the type, type number, serial number and last calibration date.

Measuring quantity: $L_{pA,\ max}$

Description of other equipment used during the measurement. In case of using a 'quiet'roll container also a description and picture(s) of the container with load included the wheels.

Load and operating condition

If laden, describe the load. Operation method.

Pictures of the load.

Speed of operation and or driving.

Measuring points

Distance to the source and height of the measuring microphone for each measuring point.

Pictures of the measuring points in relation to the measured object and in relation to the immediate surroundings.

Measured levels and processing

All the levels read for each measuring condition and each measuring point. Any intermediate results. Number of averaging operations and type of averaging.

Measurement results by type of source and measuring condition

The measurement result is in the report for each type of source and measuring condition.

11.2 Product details

The test report shall describe the product on which the measurement has been carried out become. This description shall be supported with photos, etc.

For the description, the form belonging to the product shall be included in the test report. The forms contain the generic product data, specific product data shall be added.

11.2.1 Vehicle doors, hatches, hinged and roller doors

Description of vehicle doors, hatches, hinged and roller doors:

Manufacturer	
Make	
Type	
Hinge	
Make	
Type	
Number	
Picture	Place picture here
Locking system	
Make	
Type	
Number	
Picture	Place picture here
Door grip	
Make	
Type	
Number	
Picture	Place picture here
Door catch	
Make	
Type	
Number	
Picture	Place picture here
Rubber	
Make	
Type	
Number	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	

Make	
Type	
Number	
Picture	Place picture here

11.2.2 Air curtain

Description of air curtain:

Manufacturer	
Make	
Type	
Fan	
Make	
Type	
Number	
RPM	
Picture	Place picture here
Enclosure	
Material	
Material thickness	
Picture	
Insulation material	
Insulation material	
Insulation material thickness	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.3 Roller door

Description of roller door:

Manufacturer	
Make	
Type	
Wheels	

Make	
Type	

Number	
Picture	Place picture here
Wheel bearing	
Make	
Type	
Number	
Picture	Place picture here
Locking system	
Make	
Type	
Number	
Picture	Place picture here
Rubber	
Make	
Type	
Number	
Picture	Place picture here
Stop	
Type	
Material	
Picture	Place picture here
If electric	
Electric motor	
Make	
Type	
RPM	
Picture	Place picture here
If pneumatic	
Cylinder	
Make	
Type	
Picture	Place picture here
Opening speed	
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.4 Sliding panel

Description of sliding panel:

Manufacturer	
Make	
Type	
Wheels	
Make	
Type	
Number	
Picture	Place picture here
Wheel bearing	
Make	
Type	
Number	
Picture	Place picture here
Locking system	
Make	
Type	
Number	
Picture	Place picture here
Stop	
Type	
Material	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.5 Sliding partition

Description of sliding partition

Manufacturer	
Make	
Type	
Wheels	
Make	
Type	
Number	
Picture	Place picture here

Wheel bearing	
Make	
Type	
Number	
Picture	Place picture here
Locking system	
Make	
Type	
Number	
Picture	Place picture here
Locking system	
Make	
Type	
Number	
Picture	Place picture here
Rubber	
Make	
Type	
Picture	Place picture here
Stop	
Type	
Material	
Picture	Place picture here
Rails	
Make	
Type	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.6 Steps

Description of steps

Manufacturer	
Make	
Type	
Material	
Type	

Thickness	
Picture	Place picture here
Rubber	
Make	
Type	
Picture	Place picture here
Stop	
Type	
Material	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.7 Strip curtain

Description of curtain

Manufacturer	
Make	
Type	
Wheels	
Make	
Type	
Number	
Picture	Place picture here
Wheel bearing	
Make	
Type	
Number	
Picture	Place picture here
Stop	
Type	
Material	
Picture	Place picture here
Strips	
Number	
Material	
Thickness	
Picture	Place picture here

Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.8 Tail lift

Description of tail lift

Manufacturer	
Make	
Type	
Version	rear-closing tail lift / slides underneath vehicle / internal vertical tail lift
Engine	
Make	
Type	
RPM	
Picture	Place picture here
Pump	
Make	
Type	
RPM	
Picture	Place picture here
Roll-off stop type	
Roll-off stop modifications	
Picture	Place picture here
Rollers	
Make	
Type	
Number	
Picture	Place picture here
Rubber possibly present on rear frame	
Make	
Type	
Thickness	
Number	
Picture	Place picture here

Rubber possibly present at bottom of cargo body	
Make	
Type	
Thickness	
Number	
Picture	Place picture here
Platform	
Material	
structure	
If coating present	
Make	
Type	
Thickness	
Coating material	
Coating thickness	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.9 Floor

Description of floor:

Manufacturer	
Make	
Type	
Floor	
Make	
Type	
Structure	
Thickness	
Attechment top layer	
Surface structure	
Picture	Place picture here
If coating present	

Make	
Type	

Thickness	
Surface structure	
Picture	Place picture here
Anti-skid	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.10 Wall

Description of wall:

Manufacturer	
Make	
Type	
Wall	
Make	
Type	
Material	
Structure	
Thickness	
Picture	Place picture here
If impact plate present	
Make	
Type	
Dimensions	
Attachment method	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here

PEAK-specific modification	
Part name	
Make	
Type	

Number	
Picture	Place picture here

11.2.11 Load fastening system

Description of load fastening system

Locking system	
Manufacturer	
Make	
Type	
Locking system type	
Material	
Picture	Place picture here
Rail	
Manufacturer	
Make	
Type	
Material	
Attachment method	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.12 Refrigeration unit

Description of refrigeration unit:

Manufacturer	
Make	
Model	
Type	
Where applicable: Variation on standard type:	

PEAK mode: Operating method	
Drive system type:	Powered by vehicle engine / Powered by separate diesel engine Electrically powered / Diesel-electrically powered Nitrogen unit / Carbon dioxide unit

Diesel engine	
Make	
Type	
RPM	
Picture	
Compressor	
Make	
Type	
RPM	
Picture	Place picture here
Generator frequency (where applicable)	
RPM of condenser fan(s)	
Noise insulation method:	
Enclosure material	
Material thickness	
Picture	
Where applicable for separate drive system	
Enclosure material	
Material thickness	
Picture	
Insulation	
Insulation material	
Insulation material thickness	
Insulation material type	
Picture	Place picture here
Damping fitted inside enclosure	yes/no
Where applicable: water- or air-cooled generator	
Exhaust damper	
Make	
Type	
Dimensions of exhaust damper	
Location of exhaust damper	
Release location of exhaust gases	
Picture	Place picture here
Method of mouting to	

vehicle	
	Place picture here
Other	
Part name	

Make	
Type	
Number	
Picture	Place picture here
PEAK-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here
Evaporator(operating during testing)	
Make	
Type	
Capacity	

11.2.13 QuietTruck

Description of the truck

0. General
0.1. Make (trade name of manufacturer):
0.2. Means of identification of type, if marked on the vehicle:[1]
0.2.1. Location of that marking:
0.3. Category of vehicle:[2]
0.4. Company name and address of manufacturer:
0.5. Name and address of the manufacturer's representative (if any):
0.6. Name(s) and address(es) of assembly plant(s):
0.7 Building series (model year):
1. General construction characteristics of the vehicle
1.1. Photographs and/or drawings of a representative vehicle:
1.2. Number of axles and wheels:[3]
1.2.1. Powered axles (number, position, interconnection):
1.3. Position and arrangement of the engine:
2. Masses and dimensions [4] (in kg and mm) (Refer to drawing where applicable):
2.1. Range of vehicle dimensions (overall):
2.1.1. For chassis without bodywork:
2.1.1.1. Length:
2.1.1.2. Width:

2.1.2. For chassis with bodywork
2.1.2.1. Length:
2.1.2.2. Width:
2.13. Wheelbase:

2.2. Mass in running order[5]
(a) Minimum and maximum for each variant:
(b) Mass of each version (a matrix shall be provided):
2.3. Technically permissible maximum laden mass stated by the manufacturer:[6, 7]
3. Power plant[8]
3.1. Manufacturer of the engine:
3.1.1. Manufacturer's engine code (as marked on the engine, or other means of identification):
3.2. Internal combustion engine
3.2.1. Specific engine information
3.2.1.1. Working principle: positive ignition/compression ignition, cycle four
stroke/two stroke/rotary[9]
3.2.1.2. Number and arrangement of cylinders:
3.2.1.2.1. Firing order:
3.2.1.3. Engine capacity:[10] …. cm3
3.2.1.4. Rated maximum net power: ……. kW at .....min–1 (manufacturer's declared
value)
3.2.2. Fuel feed
3.2.2.1. By fuel injection (compression ignition only): yes/no9
3.2.2.1.1. Working principle: Direct injection/pre-chamber/swirl chamber9
3.2.2.1.2. Governor
3.2.2.1.2.1. Type:
3.2.2.1.2.2. Speed at which Cut-off starts under load: …. min–1
3.2.2.2. By fuel injection (positive ignition only): yes/no9
3.2.2.2.1. Working principle: Intake manifold (single-/multi-point2)/direct
injection/other (specify)
3.2.3. Intake system
3.2.3.1. Air filter, drawings, or
3.2.3.1.1. Make(s):
3.2.3.1.2. Type(s):
3.2.3.2. Intake silencer, drawings,
3.2.3.2.1. Make(s):
3.2.3.2.2. Type(s):
3.2.4. Exhaust system
3.2.4.1. Description and/or drawing of the exhaust system:
3.2.4.2. Exhaust silencer(s):
Type, marking of exhaust silencer(s):
Where relevant for exterior noise, reducing measures in the engine compartment and on the engine:
3.2.4.3. Location of the exhaust outlet:

3.2.4.4. Exhaust silencer containing fibrous materials:
3.2.5. Catalytic convertor: yes/no9
3.2.5.1. Number of catalytic convertors and elements (provide the information below for each separate unit):
3.3. Electric motor
3.3.1. Type (winding, excitation):
3.3.1.1. Maximum hourly output .....kW
3.3.1.2. Operating voltage V
3.4. Engine or motor combination:
3.4.1. Hybrid electric vehicle: yes/no[9]
3.4.2. Category of hybrid electric vehicle: off-vehicle charging/not off-vehicle charging:9
3.4.3. Operating mode switch: with/without[9]
3.4.3.1. Selectable modes
3.4.3.1.1. Pure electric: yes/no[9]
3.4.3.1.2. Pure fuel consuming: yes/no[9]
3.4.3.1.3. Hybrid modes: yes/no[9] (if yes, short description):
3.4.4. Electric motor (describe each type of electric motor separately)
3.4.4.1. Make:
3.4.4.2. Type:
3.4.4.3. Rated maximum net power..... kW
3.4.5. PEAK-mode
3.4.5.1. Make:
3.4.5.2. Operation method:
3.4.6 AVAS
3.4.6.1 Sound level according to UN/ECE Regulation No 138 reverse test:
4. Transmission[11]
4.1. Type (mechanical, hydraulic, electric, etc.):
4.2. Gear ratios

Gear	*Internal gearbox ratios (ratios of engine to gearbox output shaft revolutions)*	*Final drive ratio(s) (ratio of gearbox output shaft to driven wheel revolutions)*	*Total gear ratios*
Maximum for CVT[12]			
1			
2			
3			
…			
Minimum for CVT			
Reverse			

4.2.1 Where relevant for exterior noise, reducing measures in the transmission compartment and on the transmission:

4.3. Maximum vehicle design speed (in km/h):[13]

5. Suspension

5.1. Tyres and wheels

5.1.1. Tyre/wheel combination(s)

(a) For tyres indicate size designation, load-capacity index and speed

category symbol;

(b) For wheels indicate rim size(s) and off-set(s).

5.1.2. Upper and lower limits of rolling radii

5.1.2.1. Axle 1:

5.1.2.2. Axle 2:

5.1.2.3. Axle 3:

5.1.2.4. Axle 4:

etc.

6. Axle

6.1.1. Axle ratio 1:

5.1.2. Axle ratio 2:

5.1.3. Axle ratio 3:

5.1.4. Axle ratio 4:

7. Bodywork

7.1. Type of bodywork:

7.2. Materials used and methods of construction:

7.3. Lateral protection (side guards) :

7.3.1. Material(s) :

7.3.2. Dimensions:

7.4. Mudgards:

7.4.1. Make:

7.4.2. Type:

7.5 Type of cabin
7.5.1. Where relevant for exterior noise, reducing measures in/at the cabin
8. Miscellaneous
8.1. Details of any non-engine devices designed to reduce noise (if not covered by other items):

1 If the means of identification of type contains characters not relevant to describe the vehicle types
covered by the type-approval certificate such characters shall be represented in the documentation by
the symbol: '?' (e.g. ABC??123??).
2 As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document
ECE/TRANS/WP.29/78/Rev.3, para. 2 -
www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html
3 Only for the purpose of defining "off-road vehicles".
4 Standard ISO 612: 1978 — Road vehicles — Dimensions of motor vehicles and towed vehicles -
terms and definitions.
(a) Where there is one version with a normal cab and another with a sleeper cab, both sets of
masses and dimensions are to be stated.
(b) Optional equipment that affects the dimensions of the vehicle shall be specified.
5 The mass of the driver is assessed at 75 kg. The liquid containing systems (except those for used
water that shall remain empty) are filled to 90 per cent of the capacity specified by the manufacturer.
The information referred to in points 2.2. (b) do not need to be provided for vehicle categories N2, N3,
M2 and M3.
6 For vehicles coupled with a trailer or a semi-trailer, which exert a significant vertical load on the
coupling device or the fifth wheel, this load, divided by standard acceleration of gravity, is included
in the maximum technically permissible mass. Please fill in here the upper and lower values for each
variant.
7 Please fill in here the upper and lower values for each variant.
8 In the case of a vehicle that can run either on petrol, diesel, etc., or also in combination with another
fuel, items shall be repeated. In the case of non-conventional engines and systems, particulars
equivalent to those referred here shall be supplied by the manufacturer.
9 Delete what does not apply.
10 This value shall be calculated (π = 3.1416) and rounded off to the nearest cm^3.
11 The specified particulars are to be given for any proposed variants.
12 Continuous Variable Transmission (CVT): transmission with variable gear ratios.
13 With respect to trailers, maximum speed permitted by the manufacturer.

11.2.14 Reversing alarm system and blind spot warning

Description of warning system

Make	
Type	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here

Peak-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.15 Rollies and dollies

Description of the rollie or dollie

Make	
Type	
Picture	Place picture here
Base	
Material	
Picture	Place picture here
Wheels	
Number	
Dimensions	
Material	
Hardness	
Picture	Place picture here
Castor	
Make	
Type	
Number	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
Peak-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.16 Roll container

Description of the roll container

Make	
Type	
Picture	Place picture here
Base	

Material	
Picture	Place picture here
Frame	
Material	
Picture	Place picture here
Wheels	
Number	
Dimensions	
Material	
Hardness	
Picture	Place picture here
Castor	
Make	
Type	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here
Peak-specific modification	
Part name	
Make	
Type	
Number	
Picture	Place picture here

11.2.17 Pallet truck

Description of pallettruck

Make	
Type	
Picture	Place picture here
Lifting capacity	
Lifting speed	
Driving speed	
Frame	
Material	
Picture	Place picture here
Wheels front	
Number	
Dimensions	
Material	
Hardness	
Picture	Place picture here
Wheels rear	

Number	
Dimensions	
Material	
Hardness	
Picture	Place picture here
Engine	
Make	
Type	
RPM	
Picture	Place picture here
Pump	
Make	
Type	
RPM	
Picture	Place picture here
Other	
Part name	
Make	
Type	
Number	
Picture	Place picture here

12. References

[1] 'Proposals for methods of measurement for peak noise during loading and unloading', TNO report HAG-RPT-980088, November 1998

[2] 'Feasibility study on reducing peak noise during loading and unloading', TNO report HAG-RPT-970095, 30 September 1997

[3] UN/ECE regulation R51 revision 3, "Uniform provisions concerning the approval of motor vehicles having at least four wheels with regard to their sound emissions", 5 February 2016, http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/updates/R051r3e.pdf

[4] UNECE RE3; United Nations Economic Commission for Europe, Consolidated Resolution on the Construction of Vehicles (R.E. 3), Revision 1, Annex 7

[5] 'Method to determine the noise capacity level in dB(A) radiated by a forklift', Vamil publication series number 3.1, October 1997, Ministry of Housing, Spatial Planning and the Environment

[6] 'Feasibility study on quiet transport refrigeration', Environmental technology publication series, number 1990/3, Ministry of Housing, Spatial Planning and the Environment

[7] 'Methods of measurement for peak noise during loading and unloading (2010 update)' TNO report MON-RPT-2010-00466, 18 February 2010

[8] 'Methods of measurement for peak noise during loading and unloading (2015 update)', Stichting Peak, 2015.

[9] 'Methods of measurement for peak noise during loading and unloading (2018 update)', Stichting Peak, 2018.

[10] UN/ECE Regulation No 85: Uniform provisions concerning the approval of internal combustion engines or electric drive trains intended for the propulsion of motor vehicles of categories M and N with regard to the measurement of net power and the maximum 30 minutes power of electric drive trains R085r1e.pdf (unece.org)

[11] UN/ECE Regulation No 138: Uniform provisions concerning the approval of Quiet Road Transport Vehicles with regard to their reduced audibility [2017/71] https://unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2017/R138r1e.pdf

[12] UN/ECE Regulation No 165: Uniform provisions concerning the approval of audible reverse warning devices and of motor vehicles with regard to their audible reverse warning signals ECE/TRANS/WP.29/2021/49 (unece.org)

13. Annex A NOVEM memo, 4 July 2002

To : Mrs de Gooijer, Mr. Niehoff, Mr. Visser
From : R. Goevaers

Copy to : Hielke Zandberg
Subject : Motivation for evaluation method for peak noise in road vehicles
Reference : Noise measurement vs 0

Introduction
These notes briefly discuss the specific noise measurements regarding the Retail Trade Decree and the peak programme.

General
The following measurement and calculation methods are used in the Netherlands:
1 Type testing: Based on EU rules for devices used outside an establishment: Noise Abatement Act, Chapter II (devices) and road traffic legislation. These devices are indicated for each Decree.
Examples include vehicles, construction equipment, lawnmowers and similar.

2 Traffic noise (under the Noise Abatement Act, Chapter VI, art. 102 +103): All traffic noise in terms of equivalent noise levels on the outer walls of homes. This therefore includes traffic noise caused by urban distribution, combined with passenger vehicles, motorcycles, etc. The legally established method is indicated in the Calculation and Measurement Directive. The rules are applied to all public roads. The legal basis is presented in the Decree by the Minister of Health and Environmental Protection of 22 May 1981, Government Gazette no. 107, most recently amended by a Decree of the Minister of Spatial Planning, Housing and the Environment of 28 March 2002, Government Gazette no. 62.

3 Industrial noise, Noise Abatement Act + Environmental Management Act: Under Chapter V of the Noise Abatement Act, Art. 73, for each specific Decree of the Environmental Management Act and for each permit directive (+ existing jurisprudence), refer to the 'Industrial Noise Measurement and Calculation Guide'. This guide describes measurement and calculation methods for transfer of noise from noise sources in and related to facilities to recipients of the noise. The results of measurements and calculations are equated within the limits of the guide. The legal basis of the Guide is given in the ministerial orders of 20 August 1982, Government Gazette no. 161, and 31 May 2001, Government Gazette no. 117.

Retail Trade Decree
The Industrial Noise Circular (1979), fully supported by existing jurisprudence, states that for establishments, therefore including retail trade, peak levels must be included in permit directives along with limits in terms of equivalent noise levels. In the 1980s, this policy was also included in the

general rules on the basis of the Abatement Act. The Retail Trade Decrees contain limits for both phenomena. This policy was continued in 1998 in the 'Retail Trade and Craft Businesses Environmental Management Decree'
(hereinafter referred to as the Retail Trade Decree), although the hard limits of the Abatement Act Decree were changed to target values. In addition to the familiar series for the equivalent noise level during the day, evening and night periods of 50, 45 and 40 dB(A), it was established that deliveries to shops in the evening and night were permitted, provided the peak levels (L_{max}) complied with the following values: Day: 07.00 am – 07.00 pm: No restrictions in terms of L_{max}. Night: 07.00 pm – 11.00 pm: 65 dB(A) maximum. Night: 11.00 pm – 07.00 am: 60 dB(A) maximum.

The competent authority may deviate from these guidelines, independently or on request, in a positive or negative sense, by setting a further requirement. This allows for optimal balancing of the interests of the operator and of the area. To determine whether loading and unloading occurs within these limits in practice, the noise level must be measured or calculated on location at the outer wall of the nearest home.

PEAK MULTI-ANNUAL PLAN

The PEAK programme has been initiated to support business in developing logistical solutions so that loading and unloading can occur within these noise limits. To measure and compare the quiet solutions developed within this programme in terms of noise performance, TNO has designed **a proprietary special method of measurement** for the **PEAK** programme whereby the results of tested objects are comparable with each other. The Retail Trade Decree specifies immission values for homes. The PEAK method of measurement is a resource for manufacturers to determine whether their equipment complies with these values in principle. The method is therefore not directly applicable for the assessment of immission levels on the outer walls of homes as incorporated in the Decree. For the assessment of these noise levels, a translation of the results of a 'PEAK measurement' can take place on the basis of the 'Industrial Noise Measurement and Calculation Guide', possibly supplemented with the 'traffic noise measurement and calculation method'. The rule of thumb is that the noise level decreases by 6 dB(A) every time the distance is doubled. These measurement and calculation methods must be applied in addition to the PEAK method of measurement to relate to practical conditions..

The basis for compiling this protocol for PEAK in addition to that of the guide was:

- The Retail Trade Decree
- As much relevance to the practical situation as possible
- 'Worst-case scenario' approach for the measurement conditions
- The method of measurement must be repeatable and provide the same results
- Simple and pragmatic evaluation method. The idea is that the methods of measurement must provide representative values that can be translated to problem situations, possibly by means of calculation. The choice was therefore made to compare noise levels (L_{max}) at a distance of 7.5 metres and a height of 1.2m above a hard surface

Lmax versus LA,eq

Another decision involved the choice of the L_{max} versus the $L_{A,eq}$ ($L_{A,equivalent}$ or in the Decree: the L_{Aeq}). L_{max} measures the maximum noise peak occurring in a short time at the standardised meter setting 'F'. $L_{A,eq}$ measures the noise level of a constant noise source over a longer time at the standardised meter setting 'S'. The purpose of the Decree is to prevent sleep disturbances and startle reactions, which are measured by the L_{max}. People are generally more easily startled awake by a sudden noise occurring suddenly – a noise peak – than by a noise that builds slowly. For example, compare a blow with a hammer and a passing car. The first example can be more of a nuisance than the second, even though they may reach the same maximum level at the location of the observer. After all, the observer is given some warning in the second case. Therefore, L_{max} was selected in addition to $L_{A,eq}$. The following remarks may be made:

- The application of the L_{max} and the $L_{A,eq}$ is consistent for all establishments in the Netherlands and is legally established in all Decrees and permit directives
- $L_{A,eq}$ is used in many (but not all) European countries; L_{max} only if sudden percussive noises may occur. Measuring noise sources using $L_{A,eq}$ provides lower values, as the time window of the 'S' setting is larger than for the 'F' setting and a peak is simply the maximum of a very short noise burst, whereas the equivalent noise level is evaluated as the energetic average over 12, 4 and 8 hours during the day, evening and night respectively. The results of $L_{A,eq}$ and L_{max} measurements must be determined using the method of measurement of the 'Industrial Noise Measurement and Calculation Guide'. The results of the "PEAK method of measurement" may only be converted to the noise load on the outer walls of homes using the guide. The values of the PEAK method of measurement and those of the Decrees therefore cannot be used in combination, or compared with each other
- The broadening of PEAK at the European level will require L_{max} to be clearly explained to prevent debate

Choice of a distance of 7.5 metres within the PEAK programme. To make the measurement results comparable, the following aspects were involved in the choice of distance:

- a set distance between the noise source and the microphone
- an environment free of obstacles
- a comparable (hard) surface between the source and receiver
- a calm environment with few sources of disruption (avoid large measuring distances because of the potential for measuring other noise sources)
- Staying out of the proximity field of the noise source
- Assume narrow streets in a city centre, with a width of approx. 15 metres, and halve this
- The measurement distances must always be equal in order to compare results

The distance from the source to homes may vary in practice from 2m (very close) to several hundred metres.

When measuring, **two issues** must be **avoided**:

- The influence of background noise. When measuring at greater distances, background noises on

the measuring microphone may influence the results of the measurement, so that the results cannot be reproduced
- The measuring distance should not be too small. When measuring close to the source, the measurement result is not reliable as one may end up in the proximity field, where measurement deviations may occur

Additional arguments for a 7.5 metre distance
- At a distance of 7.5 metres, the probability that background noise levels will affect the measurement is relatively low, as the noise source will produce a much higher level than at greater distances
- The 7.5 metre distance of the method of measurement is consistent with a measuring distance indicated in several noise methods of measurement, such as Industrial Noise, Noise Abatement Act + Environmental Management Act and ISO 362 – a measuring distance also applied in international standards
- The pragmatic choice of a distance of 7.5 metres is justified by the inner-city situation in which homes are close to a loading/unloading location
- The measuring height is prescribed in the Guide and must be maintained to make it possible to determine or maintain limits at a later stage

PEAK method of measurement and method to determine noise immission

The PEAK method of measurement serves to determine reproduceable measurement results quickly and easily so that products are mutually comparable. The PEAK method of measurement is not intended to determine noise capacity. A separate method will have to be developed to measuring the noise capacity level of each noise source that does justice to the operating conditions of the device in question. For example, the EU has developed and established such specific methods for vehicles, building equipment and so on. The noise capacity determined using these methods can be converted to immission levels near homes using the 'Industrial Noise Measurement and Calculation Guide'. The PEAK method of measurement is a proximity measurement. The immission thus measured at 7.5m may be extrapolated to greater distances using the methods in the Guide. This takes into account factors such as geometric expansion of noise, ground attenuation, shielding, reflection, molecular attenuation, meteorological conditions, etc. All municipalities, provinces and acoustic consulting firms have this Guide. Collective disturbance in an urban environment may be calculated by combining the legally established 'Industrial Noise Measurement and Calculation Guide' with the 'traffic noise measurement and calculation method', also established by law. For an indication of the extent of the influence of traffic, industry, etc., in relation to the annual average noise level, the site www.xs4all.nl/~rigolett provides an indication of L_{den} if the individual contributions of the various noise sources are known.

Evaluation of the PEAK method of measurement

The PEAK method of measurement are currently being assessed by TNO. The request submitted to TNO is to adjust a number of shortcomings discovered during practical situations. This includes a more detailed description to prevent inaccuracies in measuring.

Conclusion

The Retail Trade Decree specifies immission values for homes. The PEAK method of measurement is a resource for manufacturers to determine whether their equipment complies with these values in principle.

Determining whether or not the PEAK methods of measurements are in keeping with practical situations is more difficult. Practical situations vary greatly when it comes to distances and the composition of noise sources. However, the 'Industrial Noise Measurement and Calculation Guide' allows the PEAK value to be extrapolated to the immission value near a home with relative ease. The additional method in the 'Industrial Noise Measurement and Calculation Guide', possibly complemented by the 'traffic noise measurement and calculation method', may therefore be applied so that the PEAK method of measurement is in line with practical conditions.

It is precisely in order to be able to reproduce measurement results so that the individual noise sources can be assessed and compared that the PEAK method of measurement has been chosen. The measurement conditions have, after all, been set out in the PEAK method of measurement, i.e., the measuring distance, operating condition, situation and measuring environment, for optimal and comparable evaluation. In relation to practical conditions, however, the selected distances are always open to discussion as practical conditions will deviate from the principles of the method of measurement. After all, in practice, there is almost never an area free of obstacles, and distances other than 7.5 metres must be taken into consideration along with the presence of obstacles, which can give rise to shielding or reflection.

It can be concluded that the selected distances have been carefully chosen for the PEAK method of measurement based on several considerations, with 'optimum' as the basic principle.

TNO will be adjusting the method of measurement soon, based on the conclusions of the evaluation of the PEAK method of measurement.

14. Annex B Definitions of tasks and roles

	Manufacturer	**Local importer / distributor**	**Approval authority** (AA) Stichting-Peak	**Independent expert** (IE) (for example: UTAC / M+P/ RDW/ Cemafroid)
Request PEAK type-approval	X (participant required) If not a participant the manufacturer can support	X (participant required)		
Receiver of PEAK type-approval request			X	
Approval of family definition and representative vehicle	Participant: Provides family definition to AA and IE	Participant: Provides family definition to AA and IE	Approval the family definition	Advise to approval authority
Conducting test	X (in-house witnessed)	X (in-house witnessed)		X (supporting in-house witness test or conducting test) and issue test report
Responsibility for the accuracy of the test results and conformity as per the test protocol				X
Approve test report			X	
Signing of declaration of new product (family)	Participant that requested type-approval	Participant that requested type-approval		
Issue PEAK Type-approval certificate (available on website)			X	
Register an individual vehicle	Participant	Participant		

Accepting COP-arrangements 2.4.2.1		Participant provide conformity of control methods (process) given by a Technical Service or R51 Authority	X	
Request COP truck specification 2.4.2.3			X Optional	
Performing COP-test 2.4.2.4	participant	participant		
Approving/feedback COP-tests 2.4.2			X	

1. '**approval authority'** means the authority or authorities with competence for all aspects of the type-approval of a vehicle, system, component or separate technical unit, or of the individual vehicle approval, for the authorisation process for parts and equipment, for issuing and, if appropriate, for withdrawing or refusing approval certificates, for acting as the contact point for the approval authorities of the other countries, for designating the technical services, and for ensuring that the participant meets its obligations regarding the conformity of production;
2. **'independent expert'** means a party that provides services in the field of acoustics and that is not affiliated in any way organizationally or in legal entity with the applicant for the measurement report.
3. **'manufacturer'** means a natural or legal person who is responsible for all aspects of the type-approval of a vehicle, system, component or separate technical unit, or the individual vehicle approval, or the authorisation process for parts and equipment, for ensuring conformity of production and for market surveillance matters regarding that vehicle, system, component, separate technical unit, part and equipment produced, irrespective of whether or not that person is directly involved in all stages of the design and construction of that vehicle, system, component or separate technical unit concerned;
4. **'local importer'** means a natural or legal person established in the Union who places on the market a vehicle, system, component, separate technical unit, part or equipment that has been manufactured in a third country;
5. **'distributor'** means a dealer or any other natural or legal person in the supply chain, other than the manufacturer or the importer, who makes available on the market a vehicle, system, component, separate technical unit, part or equipment;