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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (prEN 1501-4:2004) has been prepared by Technical Committee CEN/TC 183 “Waste management”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, B, C or D, which is an integral part of this document.

The annexes A and B are normative, the annexes C and ZA are informative.

Introduction

This European Standard deals with the measurement of noise emitted by refuse collection vehicles (RCVs) in view of the declaration and marking of the noise emission level to fulfill the requirements of EU Directive 2000/14 on the approximation of the laws of the Member states relating to the noise emission in the environment by equipment for use outdoors. It also covers the noise information requirements of EU Directive 98/37 on the approximation of the laws of the Member states relating to machinery.

1 Scope

This European Standard defines the measurement of noise emitted by refuse collection vehicles (RCVs). Its goal is to obtain the sound pressure level at the operator’s position and the sound power level of RCVs.

The test results obtained in accordance with this standard are also applicable to the evaluation of the hazards generated by noise from RCVs.

This standard deals with the noise measurement conditions for the types of refuse collection vehicles defined and described in the standards of the series EN 1501.

This standard addresses the uncertainties due to measurement procedures.

This standard does not address the discharge operation as this operation is short in time (1 % of the working period) with a sound pressure level equivalent to the sound pressure level of the main operation.

In view of the wide variety of RCVs, it could be appropriate to refer to individual RCVs as falling into classes or groups (model of equipment within a given type of equipment) having in common specific features regarding noise measurements and characteristics. A possible classification is proposed in an informative annex, enabling both producers and users to address a limited number of well defined classes/groups suitable for determination of noise emission values.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 292-2:1996, *Safety of machinery — Basics concepts, general principles for design — Part 2: Technical principles and specifications*.

prEN 840-1:2001, *Mobile waste containers — Part 1: Containers with 2 wheels with a capacity up to 400 l for comb lifting devices — Dimensions and design.*

EN 1452-2:1999, *Plastics piping systems for water supply — Unplasticized poly (vinyl chloride) (PVC-U) — Part 2: Pipes.*

EN 1501-1:1998, *Refuse collection vehicles and their associated lifting devices — General requirements and safety requirements — Part 1: Rear-end loaded refuse collection vehicles*.

prEN 1501-2:2000, *Refuse collection vehicles and their associated lifting devices — General requirements and safety requirements — Part 2: Side loaded refuse collection vehicles*.

prEN 1501-3:[1)], *Refuse collection vehicles and their associated lifting devices — General requirements — Part 3: Front-end loaded refuse collection vehicles*

EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free-field over a reflecting plane*.

EN ISO 4871:1997, *Acoustics — Declaration and verification of noise emission values of machinery and equipment.*

EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specific positions — Engineering method in an essentially free field over a reflecting plane.*

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in EN ISO 3744:1995, EN ISO 4871:1995, EN ISO 11201:1995 and in the series standards of EN 1501 apply, together with the following:

3.1
A-weighted emission sound pressure level at the operator's position for a series of operating conditions, L_{pAZ}
the average sound pressure level at the operator's position from different operating conditions, determined in accordance with the equation

$$L_{pAZ} = 10 \lg \{[1/(a+b+c+d)] \times [(a \times 10^{0,1 L_{pAa}} + b \times 10^{0,1 L_{pAb}} + c \times 10^{0,1 L_{pAc}} + d \times 10^{0,1 L_{pAd}})]\} \text{ dB}$$

where

a_p is the proportion factor – chassis operation (5.3);

1) Under elaboration

b_p is the proportion factor – compaction operation (5.4);

c_p is the proportion factor – lifting operation (5.5);

d_p is the proportion factor – waste falling operation (5.6);

L_{pAa} is the A-weighted emission sound pressure level at the operator's position during chassis operation;

L_{pAb} is the A-weighted emission sound pressure level at the operator's position during compaction;

L_{pAc} is the A-weighted emission sound pressure level at the operator's position during lifting;

L_{pAd} is the A-weighted emission sound pressure level at the operator's position with waste falling.

3.2
A-weighted sound power level for a series of operating conditions, L_{WAZ}
the average sound power level from different operating conditions, determined in accordance with the equation

$$L_{WAZ} = 10 \lg \{[1/(b+c)] \times [(b \times 10^{0,1 L_{WAb}} + c \times 10^{0,1 L_{WAc}})]\} \text{ dB}$$

where

b_w is the proportion factor – compaction operation (5.4);

c_w is the proportion factor – lifting operation (5.5);

L_{WAb} is the A-weighted sound power level during compaction;

L_{Wac} is the A-weighted sound power level during lifting.

4 Installation and equipment

4.1 Test environment

For the test site, test environment and measurement conditions, the requirements of EN ISO 11201:1995 and EN ISO 3744:1995 shall be fulfilled.

4.2 Equipment and condition of the RCV

Measurements shall be made on a sample RCV that has the noise emission characteristics of series production RCVs or of a specific RCV class or group.

4.3 Position of the RCV during measurement

The RCV shall be positioned with its longitudinal axis along the x-axis of the co-ordinate system used to fix the microphone positions and with its mid-length L/2 over the origin "O" (see Figure B.1).

5 Operating conditions during measurement

5.1 Fan speed

If the engine of the equipment or its hydraulic system is fitted with one or more fans, it (they) shall operate during the test. The fan speed to be used shall be in accordance with one of the following conditions, depending on the conditions set by the manufacturer of the equipment, and shall appear in the test report, this speed being used in further measurements.

a) Fan drive directly connected to the engine:

if the fan drive is directly connected to the engine and/or hydraulic equipment (e.g. by belt drive) it shall operate during the test.

b) Fan drive with several distinct speeds:

if the fan can work at several distinct speeds the test shall be carried out either

— at its maximum speed (related to the speed of the engine), or

— in a first test with the fan set at zero speed and in a second test with the fan set at maximum speed (related to the speed of the engine).

c) Fan drive with continuously variable speed:

if the fan can work at continuously variable speeds, the test shall be carried out either according to 5.1b) or with the fan speed set by the manufacturer at no less than 70 % of the maximum speed (related to the speed of the engine).

5.2 Engine

For these measurements the RCV shall be tested in a stationary position, the engine (driving device) and hydraulic system of the equipment shall be warmed up in accordance with the instructions, and safety requirements shall be observed. No signalling device such as a warning horn or reversing alarm shall be operated during the test.

The speed of the engine during the test shall be recorded and appear in the test report.

If the RCV is fitted with several engines and/or aggregates they shall work simultaneously during the tests.

If this is not possible, each possible combination of engine(s) and/or aggregates shall be tested.

For each type of RCV that is to be tested under load, specific operating conditions shall be laid down which shall, in principle, produce effects and stresses similar to those encountered under actual working conditions.

5.3 Chassis operation

Before making noise measurements, the engine and hydraulic system of the equipment shall be warmed up in accordance with the instructions, and safety requirements shall be observed.

The noise measurements shall be carried out with the RCV in a stationary position without operating the compaction and lifting mechanisms. For the purpose of the test, the engine shall be warmed up and set up at the maximum speed provided by the engine manufacturer.

The speed of the engine during the test shall be recorded and shall appear in the test report.

If the RCV is fitted several engines, they shall work simultaneously during the tests. If this is not possible, each possible combination of engine(s) shall be tested.

This test is not carried out for RCVs with electrical supply only.

5.4 Compaction system operation

For noise measurements with the compaction system operating, the body of the RCV and the hopper receiving the waste shall be empty.

If the engine is set up to the maximum working speed of the chassis when the compaction system is running, this speed shall be measured. If the measured speed is lower than the speed provided by the manufacturer by more than 5 % the test shall be carried out with the engine accelerated by the cab accelerator, to ensure the engine working speed provided by the engine manufacturer.

If the engine speed for the compaction system is not provided by the manufacturer or if the vehicle is not provided with an automatic accelerator, then the engine working speed, issued by the cab accelerator, shall be 1 200 rpm.

5.5 Lifting of empty waste container(s)

For noise measurements during lifting operations, the following procedures shall be carried out:

a) Comb lifting device:

the lifting device shall run up and down, lifting an empty waste container. The container shall be two-wheeled, with a 240 l capacity, made of plastic and complying with EN 840-1:1997. If such a container is not available, one with a capacity of 240 l ± 10 % shall be used for this operation. The engine speed shall be determined and controlled as for the compaction system running (5.4);

b) other lifting devices ;

the lifting device shall run up and down, lifting an empty waste container. The smallest container with a capacity as near as possible to 240 l shall be used for this operation. The engine speed shall be determined and controlled as for the compaction system running (5.4).

5.6 Waste falling into the refuse collection vehicle

5.6.1 Materials to be used

For noise measurements during the waste falling operation, the materials to be used shall comprise 30 tubes of PVC-U, each with a 0,4 kg approximate mass and with the following dimensions, according to EN 1452-2.

— length: 150 mm ± 0,5 mm

— nominal external diameter: 90 mm ;

— nominal depth: 6,7 mm ;

— volumic weight: minimum: 1 350 kg/m^3, maximum: 1 460 kg/m^3 ;

— minimum resistance (MRS) 25 MPa.

5.6.2 RCVs with a lifting device

The materials specified in 5.6.1 shall be emptied in bulk into the hopper (initially empty) from a container as specified in 5.5 attached to the lifting device.

5.6.3 Hand loading

For an RCV without a lifting device, the materials specified in 5.6.1 shall be emptied in bulk into the hopper (initially empty) from a suitable container located on the rave rail with overhang not less than 200 mm.

6 Noise measurement

6.1 Instrumentation

For the instrumentation, the requirements of EN ISO 11201 shall be fulfilled relating to measurements of the sound pressure levels at the operator's position, and the requirements of EN ISO 3744 shall be fulfilled relating to the measurements to determine the sound power levels.

6.2 Microphone positions

6.2.1 Microphone positions for the sound pressure levels at the operator's position

The microphones shall be positioned in accordance with the requirements given in Figure B.2.

6.2.1.1 Cab

The sound pressure level shall be measured in the cab at the driver's ear position, with the doors closed.

6.2.1.2 Rear-loaded RCVs

The sound pressure level shall be measured 0,5 m from the control panel measured at an angle of 45° outwards from the RCV and 1,7 m above ground level (see Figure B.2) except in the case of discharge door work station(s), where no measurements are made.

6.2.1.3 Other types of RCVs

The sound pressure level shall be measured 0,5 m from the control panel and 1,7 m above ground level (see Figure B.2) except in the case of discharge door work station(s), where no measurement are made.

6.2.2 Microphone positions for determination of the sound power levels

The microphones shall be positioned in accordance with the requirements given in Figure B.1.

6.3 Measurement period

The measurement periods to be used for determination of both the emission sound pressure levels at the operator's positions and the sound power levels shall be as follows:

6.3.1 Chassis operation

At least 15 seconds.

6.3.2 Compaction system operation

If the compaction system is running automatically, at least three complete cycles of the system shall be included. If the compaction system is not running automatically but cycle by cycle, measurements shall be carried out during at least three cycles. If the cycle time of the compaction system is not fixed by design and construction, it shall be equal to that given in the body data provided by the manufacturer.

6.3.3 Lifting an empty waste container

At least three continuous complete work-cycles (emptying cycles) shall be included, each composed entirely of lifting up and lifting down. If the cycle time of the lifting device is not provided by the manufacturer, it shall be equal to that given in the lifting be used .