ODELIA

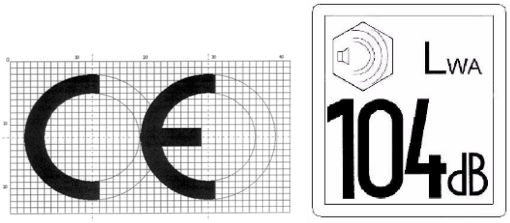
OutDoor Equipment Noise LImit Assessment

Final Study Report for

European Commission
Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

GROWTH
Internal Market, Industry, Entrepreneurship and SMEs

Tender No 414/PP/ENT/119427
Study on the suitability of the current scope and limit values of Directive 2000/14/EC relating to the noise emission in the environment by equipment for use outdoors



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TNO report

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Study on the suitability of the current scope and limit values of Directive 2000/14/EC relating to the noise emission in the environment by equipment for use outdoors Final Report

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Summary

An assessment has been made of the outdoor equipment noise directive 2000/14/EC and its amendment 2005/88/EC in relation to

- the limit values for equipment listed in Article 12, as to whether these could be modified in the light of the latest evidence such as the development of the state of the art concerning their performance characteristics;
- equipment listed in Article 13, as to whether any, or all, of this equipment should be assigned mandatory limit values;
- new equipment types which could feasibly be included in a future Regulation, meeting the generic description of 'equipment for use outdoors' in Article 3(a) or a foreseeable adaptation of this description, for this equipment to be assigned limit values in a future Regulation and what these should be;
- identifying and proposing the test methods for the measurement of sound power levels.

Proposals have been made for each of the above points taking available reports, papers, documents and data into account from 2007 until the present. Several criteria were applied in this assessment including

- member state requests and information,
- environmental impact,
- stakeholder information from industry, notified bodies, authorities and NGOs,
- technical progress including databases of declared values
- economic impact,
- quality of the test codes.

Decision diagrams have been applied in the analysis to explain the application of criteria.

Industry associations, authorities, NGOs and CEN have provided documented feedback on the environmental, technical and economic considerations of changing limits, new equipment and test codes.

Databases of declared noise values from the European Commission, ISPRA (MARA, Italy) and NPRO (UK) were used in the analysis to investigate current performance and pass rates for the various limit proposals. Despite some lack of data or missing parameters for several equipment types, large numbers of data samples are available for many equipment types, increased in numbers and content by combining the databases. Shortcomings and errors in the databases have been taken into account, partly in cooperation with industry associations.

All the decisions to tighten existing limits or introduce limits for some types of equipment are based on the consideration that noise limits must be the main policy instrument to ensure that excessive and unnecessary noise is controlled at source, within reasonable technical and economic means. Other instruments at national level such as local regulations for noise reception levels, usage times, bans and permits should be considered complementary supporting actions. Their extent and enforcement may differ considerably between member states.

The environmental need for the reduction or the introduction of limits has been evaluated on the basis of the environmental impact indicator, calculated using the same methodology used in the Nomeval study, but updated where necessary. Also environmental stakeholders' comments and member state requests have been taken into account.

The technical feasibility for the reduction or the introduction of limits has been assessed from the databases, the product data available on the internet, the information from stakeholders and the presence of quieter models on the market, taking into account known technical solutions and constraints. Where data is lacking but noise emission and environmental impact is high, limits have been proposed that will need further data collection and assessment, for example for piling machines.

The economic feasibility for the reduction or the introduction of limits has also been assessed qualitatively, taking into account the estimated pass rate of the limits, where possible, and the technical effort required to meet these limits. The expected long period until the introduction of the future limits make them also economically feasible even for those equipment types for which little progress in the noise emission has been made to date.

Test codes
The test codes have been evaluated for each equipment type, indicating where improvements or changes are necessary, in particular with reference to new or updated standards, many of which have been revised over the last 8 years. Some however still remain an obstacle due to lack of a suitable code, shortcomings or lack of measured data. CEN has provided feedback from the Technical Committees which has been included in the evaluation in this study. A general issue is the resolution of horizontal issues in the standards, such as process noise, work cycle, test conditions, common references and others.

For machines currently in Article13 or outside the scope, the lack of a suitable test code, large uncertainty factor, presence of process noise, local regulations or large size of machines should not be obstacles to proposing noise limits if the need is established. Test codes with shortcomings should be worked on to allow timely introduction of new limits.

Equipment currently in Article 12
For equipment currently in Article 12, tighter limits have been proposed for 10 equipment types, while none have been proposed to move Article to 13. For some of the equipment types with a low environmental impact the limits have not been changed, as well as for some equipment with a medium impact if current limits have been considered already sufficient, or the changes technically or economically not feasible.

Tighter limits are proposed for:
- 8. compaction machines (Walk-behind vibrating rollers, Vibratory rammers, Vibratory plates),
- 9. Compressors,
- 10. Concrete-breakers and picks, hand-held,
- 32. Lawnmowers (excluding agricultural and forestry equipment, …),
- 33. Lawn trimmers/lawn edge trimmers,

- 36. Lift trucks, CE driven, counterbalanced (excluding 'other counterbalanced…),
- 38. Mobile cranes,
- 45. Power generators (< 400 kW),
- 57. Welding generators

Equipment currently in Article 13
For equipment currently in Article 13, limits have been proposed for 28 equipment types. Only one obsolete equipment type has been proposed for removal from the directive (explosion rammers). Other equipment types with low environmental impact have been proposed to remain in the directive in order to avoid the re-emergence of noisy products.

For 4 equipment types, different limits for electric and CE powered machines have been proposed (Chainsaws, Hedge trimmers, Leaf blowers and Leaf collectors). These proposals were supported by evidence from the databases or by the collection of a significant amount of data from company websites.

New limits are proposed for:
- 1. Aerial access platforms with combustion engine
- 2. Brush cutters
- 5. Building site circular saw bench
- 6. Chain saws, portable (CE and Electric)
- 7. Combined high pressure flushers and suction vehicles
- 11. Concrete or mortar mixers
- 13. Conveying and spraying machines for concrete and mortar
- 15. Cooling equipment on vehicles
- 17. Drill rigs (percussive)
- 22. Glass recycling containers
- 24. Grass trimmers/grass edge trimmers
- 25. Hedge trimmers (CE and Electric)
- 26. High pressure flushers
- 28. Hydraulic hammers
- 30. Joint cutters
- 34. Leaf blowers (CE and Electric)
- 35. Leaf collector (CE and Electric)
- 36b. Lift trucks, CE driven, couterbalanced (others excl. Container handling)
- 39. Mobile waste containers
- 42. Piling equipment (Percussive and Vibrating + Static)
- 45 b. Power generators (≥ 400kW)
- 46. Power sweepers
- 47. Refuse collection vehicles
- 49. Scarifiers
- 50. Shredders/chippers
- 52. Suction vehicles
- 55. Truck mixers
- 56. Water pump units (not for use under water)

New equipment types
The list of potential new equipment to add to the Directive is almost the same as in the Nomeval study, reconsidered in the light of current information. Among the 22 types, 9 have been considered out of the scope of the directive, of insufficient

impact or covered by other regulation, 3 types are proposed to be put into Article 13 and 10 types into Article 12:
Proposed for Article 13:
- 107. Portal cranes for harbours and terminals
- 102. Mobile sieve installations and
- 103. Mobile waste breakers (wood, concrete)

Proposed for Article 12:
- 108. Vehicle mounted loader cranes (same limits as mobile cranes)
- 109. Walk-behind road sweepers, no aspirators (same limits as road sweeper)
- 110. Street washing machine (same limits as road sweeper)
- 111. Snowmobiles
- 115. Telescopic or pole pruner a. CE-powered b. Electric (same limits as chainsaws)
- 117. Straddle carrier and 118. Reach stacker (same limits as lift trucks)
- 119. Handheld stone cut-off saw
- 120. Stone chainsaw (same limits as chainsaws)
- 121. Swimming pool pumps (same limits as water pumps)
- 122. Air suction refuse vehicles (same limits as High pressure flushers or suction vehicles)

Nine new equipment types are proposed not to be included:
- 100. Airco/ ventilation equipment (other regulation)
- 101.Heat pumps (other regulation)
- 104.Tractors for construction and water pumping (other directive)
- 105.Reverse movement alarm signals (all machines) (out of scope)
- 106.Non-fixed lifting gear, own power source (too little information and low impact)
- 112.Quad (off-road) (out of scope, other directive)
- 113. Golf green edger (currently too small numbers and impact)
- 114.Bird scare canons/Gas guns (out of scope)
- 116.Tree stump grinder (currently too small numbers and impact)

Contents

Appendices

1 Introduction

1.1 Background

Directive 2000/14/EC [1] is part of the European Union's strategy to reduce noise at source, in particular noise emissions from equipment for use outdoors, and to provide relevant information to purchasers, users and citizens to encourage the choice of quieter equipment. The Directive requires noise marking for 57 types of equipment used outdoors, and sets noise limits for 22 of these.

First stage noise limits applicable from January 2002 were to be reduced by a second stage applicable from January 2006. But an amending Directive, 2005/88/EC [2] made the second stage limits merely indicative for certain types of equipment as they were not considered technically feasible by that time. These limits remain unchanged until the present.

Guidance on the application of the directive is provided in [3] and [4] .

Since the limits have remained unchanged for many years, there is now a compelling need to revise the existing limit values and introduce new equipment types where justified, inside or outside the directive.

1.2 Scope and tasks of this study

This study, which is in response to EU Call for tenders No 414/PP/ENT/119427 [5] , addresses this need. It does not address other aspects of the revision such as provisions on labelling, conformity assessment or the relationship with harmonised standards.

The main tasks of the study are:

- Task 1: to perform an assessment of the limit values in respect of equipment currently in the scope of directive 2000/14/EC , as amended by directive 2005/88/EC , where such limits already apply, either in substantive or indicative form, i.e. those listed in Article 12, with a view to advising on whether, and, if so, precisely how, such figures should be revised in a future Regulation in the light of the latest evidence e.g. on the development of the state of the art concerning their performance characteristics.
- Task 2: to perform an assessment of equipment currently in the scope of directive 2000/14/EC, where such limits do not apply, i.e. those listed in Article 13, with a view to advising on whether it is appropriate for any, or all, of this equipment to be assigned mandatory limit values in a future Regulation and, if so, what these should be.
- Task 3: to perform an assessment of equipment not currently in the scope of directive 2000/14/EC but which could feasibly be included in a future Regulation, i.e. it meets the generic description of ‘equipment for use outdoors’ in Article 3(a) or a foreseeable adaptation of this description, with a view to advising on whether it is appropriate for any, or all, of this equipment to be assigned limit values in a future Regulation and, if so, what these should be.

- Task 4: To identify and propose the test methods for the measurement of sound power levels in order to allow the assessment of the compliance of equipment with the required limit values.

1.3 Link with previous activities

In 2007 the NOMEVAL study [6] was performed by the TNO/TÜV Nord/VCA/LNE consortium for DG Enterprise to evaluate the effectiveness of the Directive and the possibility of lowering noise limits, introducing new ones and adding new equipment types. The study also included a stakeholder consultation, an impact assessment and broader evaluation of the directive. This was followed by a detailed impact analysis study in 2009 by Arcadis [7] including a further market consultation and a separate impact assessment study on conformity of SMEs [8]. In 2010 the stakeholder group Working Group 7 made a new evaluation of limit proposals and equipment types based on the previous studies [9]. Also subtypes of equipment and definitions found in the guidelines [3] were evaluated.

In the last few years, the notified bodies provided some guidelines on uncertainty [10] and other aspects such as test conditions for hybrid powered equipment [11]. Also, some individual studies have been performed, some at national level, to assess noise emission levels of different types of equipment including lawnmowers [12] chainsaws [13-16], shredders [17] and others.

Over the past seven years also many more noise data have been collected by the Commission in an EU database and also by national authorities, meaning there is more recent data available to assess noise levels. For certain product groups, further developments in technology and in the market have resulted in noise reductions. For some product groups, quieter versions have appeared including shredders, chainsaws, municipal vehicles, high pressure water jet cleaners and others.

Since 2010 the Commission considered whether to merge the 2000/14/EC directive with the Machinery Directive 2006/42/EC [21]. After some research it was decided not to move forward with this as the Machinery Directive does not set noise limits, even though it sets out mandatory essential requirements on machinery noise in relation to occupational safety. The CEPS study from 2013/14 [18] reports on the various policy alternatives for this issue. The preferred option was to maintain the two directives separately, which has been accepted by all industry stakeholders [19]. Continued importance was attached to the stating of noise values on the equipment through labelling and if justified the imposition of limits.

The OND is consistent with the 7th general Union Environmental Action Plan (EAP) [20], in which the third key action area covers 'challenges to human health and wellbeing, such as air and water pollution, excessive noise, and toxic chemicals'. Amongst others, the EAP sets out 'commitments to improve implementation of existing legislation, and to secure further reductions in air and noise pollution'.

1.4 Report structure

The methodology and applied principles are presented in chapter 2. The relevant background documents and most recent data are evaluated in chapter 3. Current trends in environment, technology and market are discussed in chapter 4. The main study tasks are addressed in chapters 5 to 9, with summary tables of limit proposals in chapter 9, followed by conclusions and recommendations in chapter 10. The environmental impact indicator is described in Appendix B. An analysis of the available declaration data from the E, Italian and UK databases is given for each equipment type in Appendix C. Datasheets containing details and recommendations for each equipment type are provided in Appendix F.

2 Methodology and principles

The methodology and general principles applied in this study are set out here.

Key questions to be answered for the four main tasks are the following:
- Are previous findings and recommendations from studies and papers since 2007 still valid;
- Is new information and evidence available that supports additional or different conclusions from these documents, in particular the NOMEVAL study and the WG7 paper.

2.1 Work procedure

A flowchart of the work procedure in this study is shown in figure 1 below.

The available documents and data were first reviewed. An initial analysis was made to obtain a first indication for changes in scope, limits and test methods based on evaluation of the available documents and data. After comments from the Commission and stakeholders a further, more detailed and focussed analysis was performed taking this feedback and any new information into account.

2.2 Criteria for limit revision

Limit revision or new limits are based on the following criteria:
- environmental need: relevance for noise problems in one or more member state and requests or specific information from member states including policy or position papers;
- environmental impact: medium or high, e.g. high noise levels, large numbers of affected population;
- technical feasibility: technical progress and available new technology if evident; This includes evidence from databases and the public domain where available and reliable, using statistical analysis including pass rates
- economic impact: manufacturing and R&D costs if evident;
- potential uncertainty in measured results and suitability of test method.

A generic procedure of introducing and modifying noise limits for the OND is shown in figure 2 below. When a new equipment type is introduced in Article 13, data can be collected to assess typical noise levels. When introduced into Article 12 a first appropriate limit has to be derived. Subsequent stages of lower limits are typically 2-3 dB lower and require around 3-4 years or longer to be introduced.

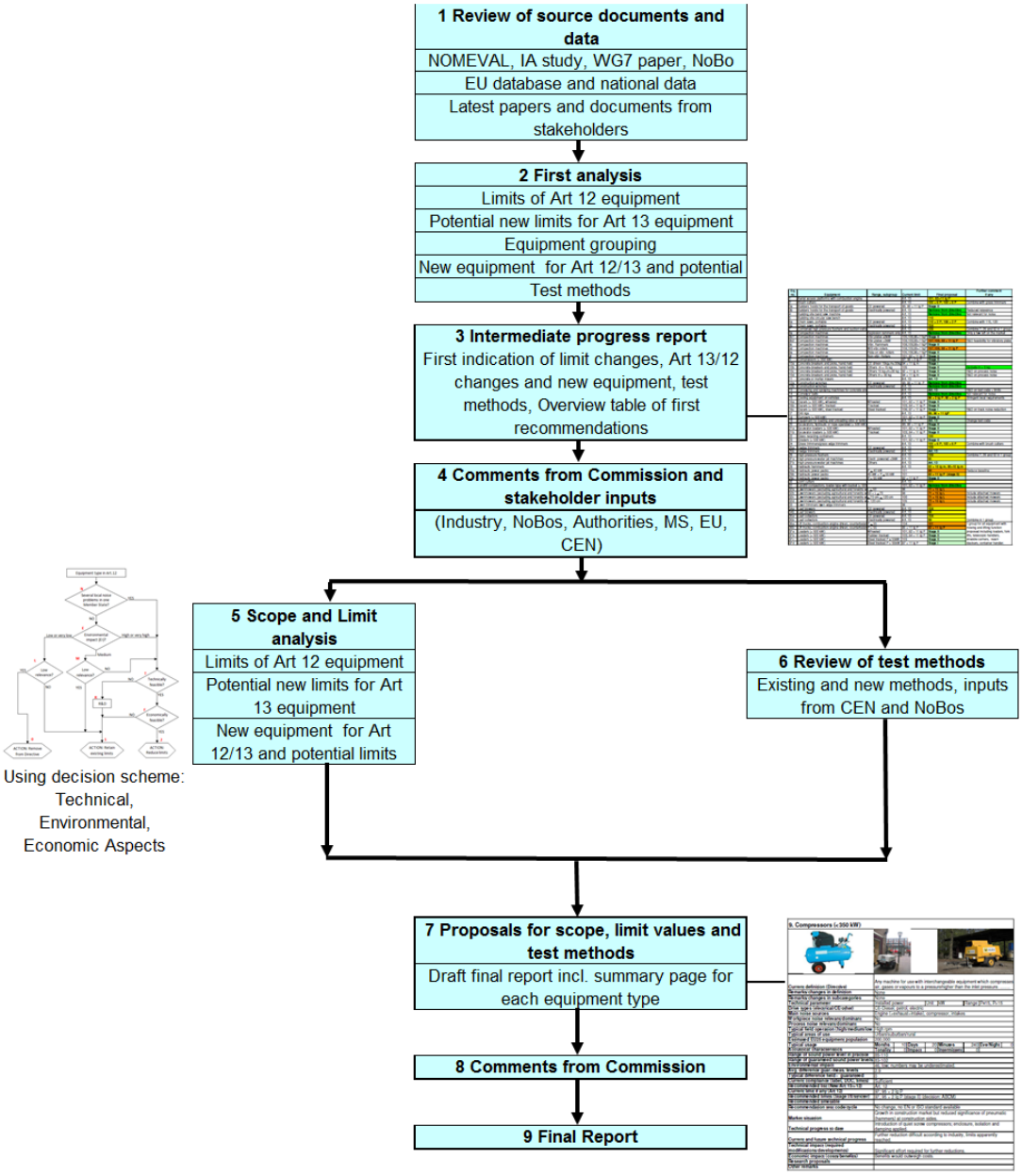

Figure 1: ODELIA Project flowchart

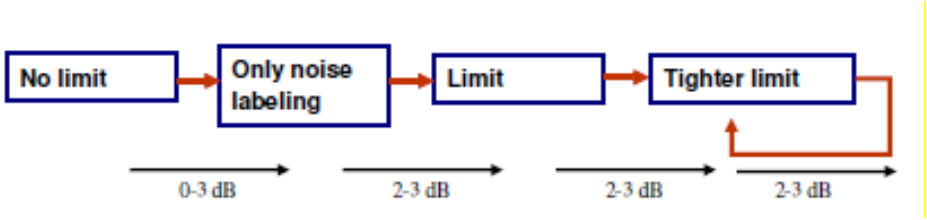

Figure 2: Typical evolution of average noise emission of equipment following introduction of noise labelling, first stage and subsequent stage noise limits (from NOMEVAL report).

A noise limit is only justifiable if the environmental noise level is significant, affecting a large number of people. Tightening a limit is only useful down to a certain point where the noise impact is acceptable. This can be assessed by the noise level but also by the numbers of equipment, their frequency, duration and time of use, and typical area and distance to the receiver. A lower noise limit is also only justifiable if the technology is available and affordable, not pushing up costs disproportionately.

When setting a new limit, it should be based on typical or average measured values increased by the expanded measurement uncertainty K. It was found in the Nomeval study that for Article 12 equipment, K is typically 2 dB, and for Article 13 equipment 3 dB or more.

For equipment types that have been particular topics of discussion in the past, the previous argumentation for keeping the same limits is reviewed, for example for:
- combustion engine powered equipment, in relation to the stated conflict between noise and cooling requirements;
- the trade-off between performance and noise;
- costs of technical means of noise reduction;
- the contribution of process noise;
- need for EU limits in relation to local regulations and permits.

2.3 Decision procedures

The decision procedures shown in figures 3a-e are applied to provide the rationale and criteria of the recommendations for each equipment type. These procedures are based on those applied in the NOMEVAL study, but here are split up into separate parts related to each task of the study and expanded for the test methods. The decision diagrams may not always provide the full map of possibilities, but cover most cases. They are valid for the scope of this study for the purpose of documenting the decisions taken for each equipment type. Any other use beyond this study requires due consideration.

The first decision block for 'severe local noise problems in one member state' is for the special case that there is a member state request which can be supported by others, and would require EU consensus to be accepted. The environmental impact is determined in any case. Even if the Environmental impact indicator is estimated as low in this study, there may be circumstances or other evidence under which it may still be justified to include a certain equipment type in the directive.

The term 'Low relevance' is used in the context of this study for the case that an equipment type is becoming obsolete or is already obsolete. For new equipment it indicates low equipment numbers not expected to increase in the medium term.

Decision flow chart for noise limits: equipment currently in Art.12

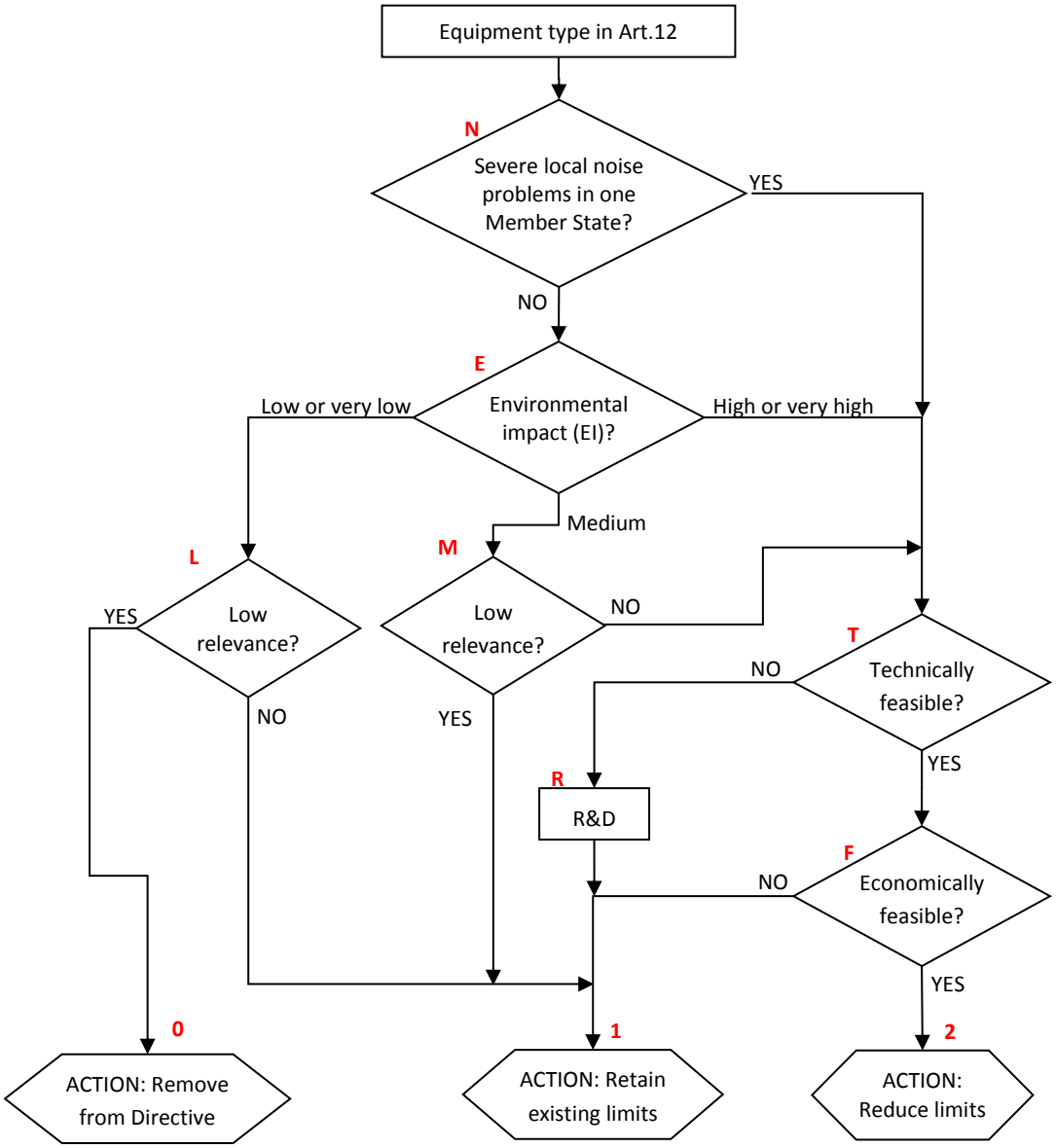

Figure 3a: Decision flow chart for noise limits for equipment types currently in Article 12 (Task 1).

Decision flow chart for noise limits: equipment currently in Art.13

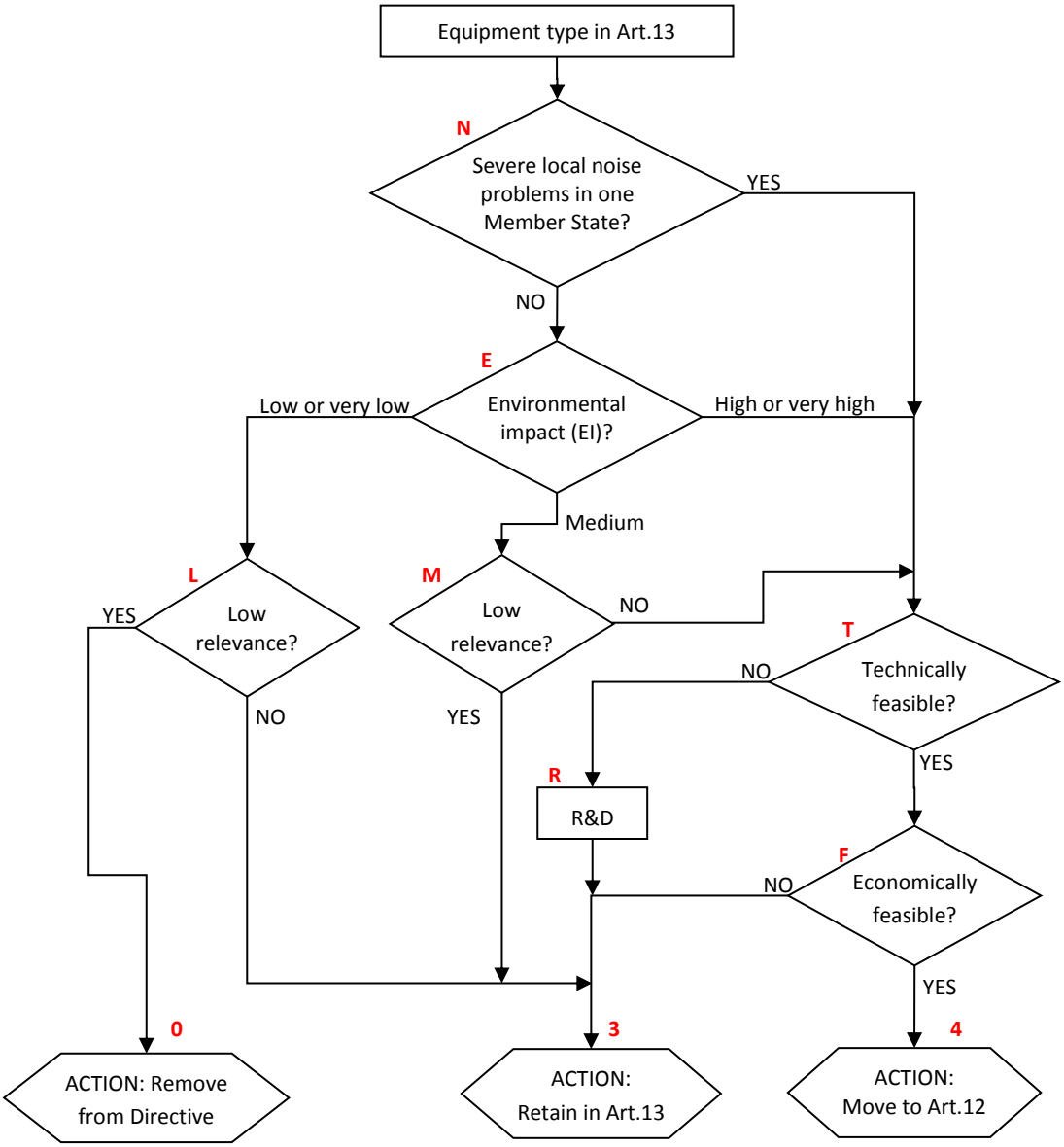

Figure 3b: Decision flow chart for noise limits for equipment types currently in Article 13 (Task 2).

Decision flow chart for noise limits: equipment currently outside the scope of the Directive

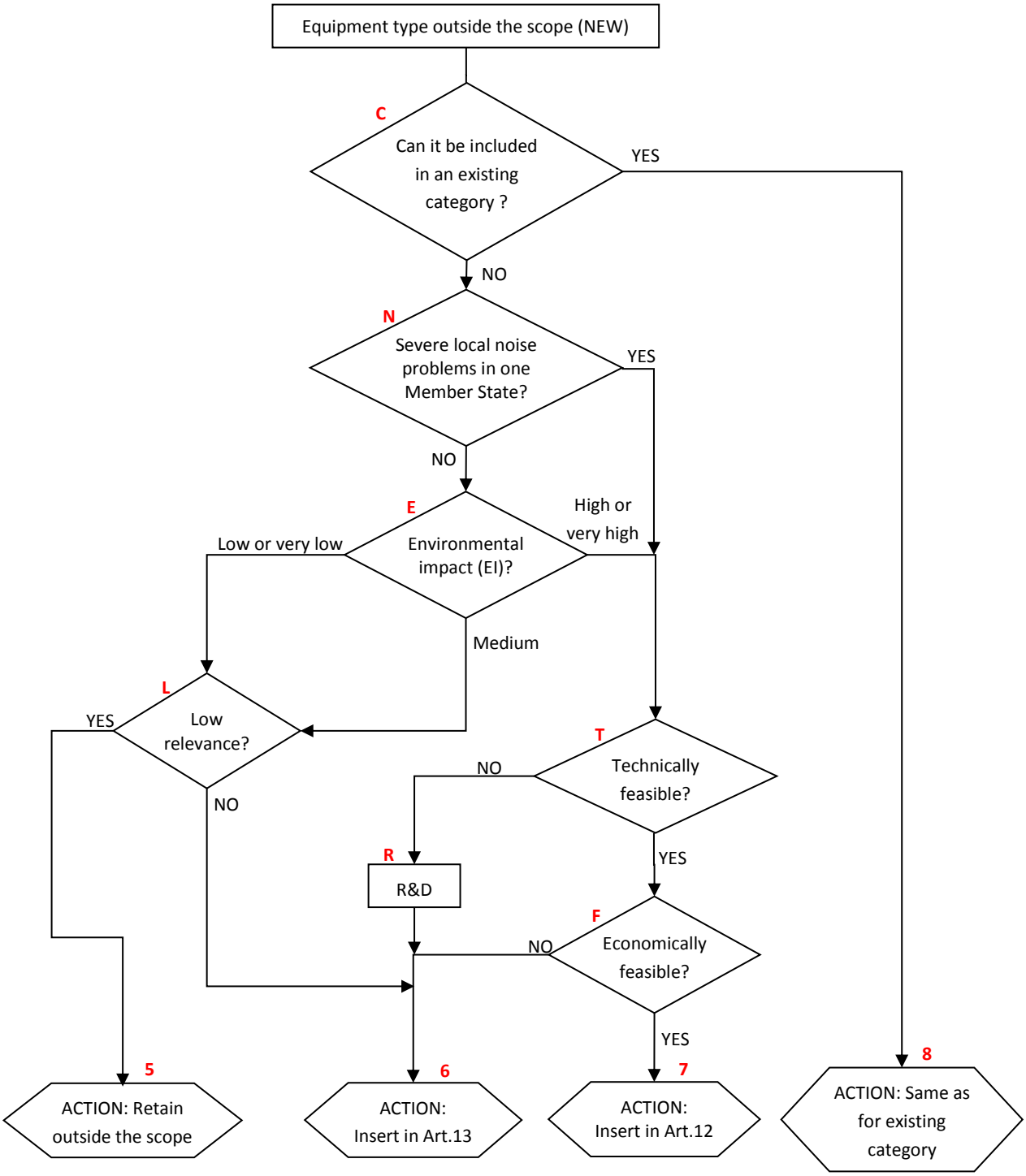

Figure 3c: Decision flow chart for noise limits for new equipment types currently outside the scope of the directive (Task 3).

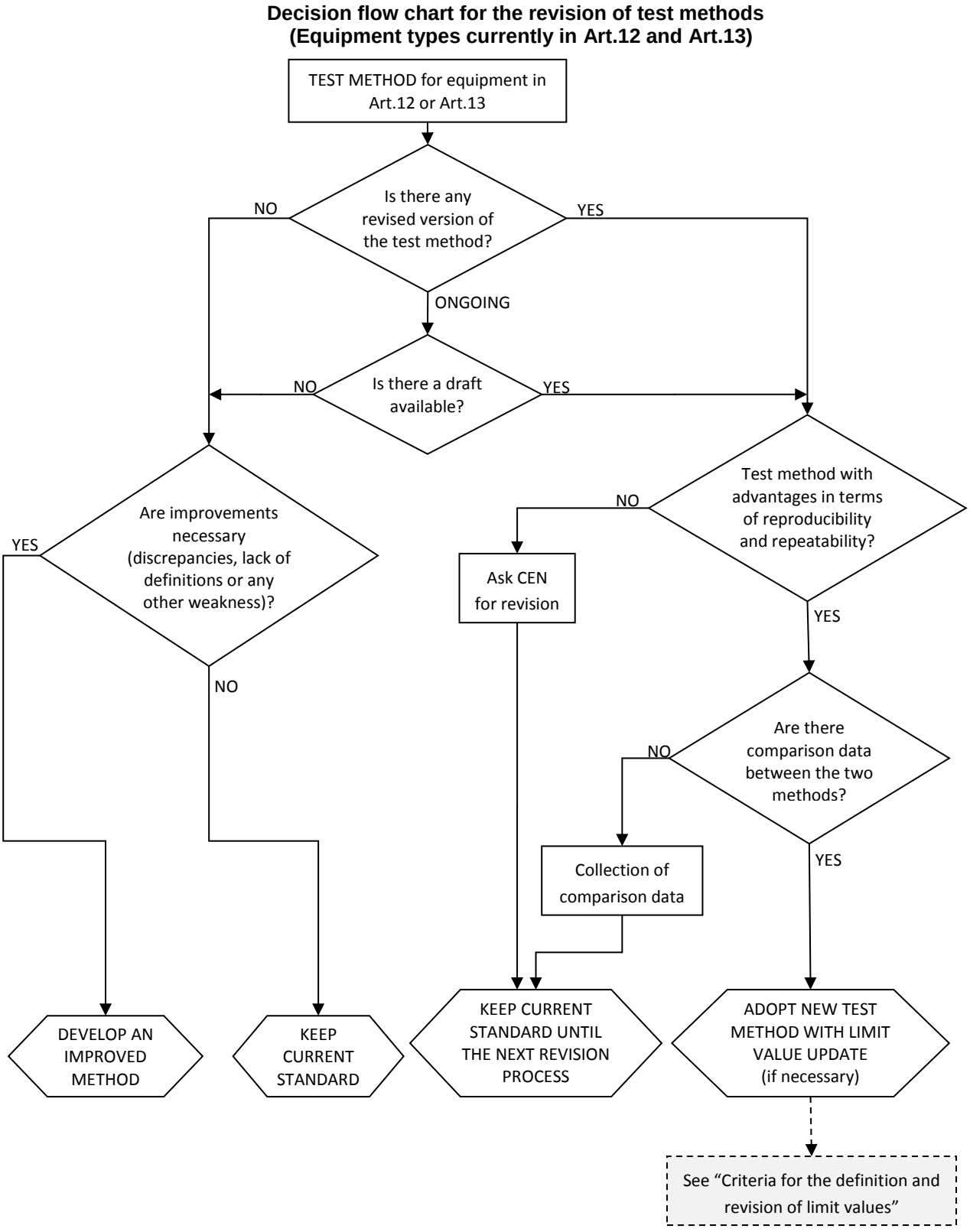

Figure 3d: Decision flow chart for test methods for equipment currently in the scope of the directive (Task 4).
For criteria see box in section on Methodology/Main analysis.

Decision flow chart for the revision of test methods
(Equipment types currently outside the scope of the Directive)

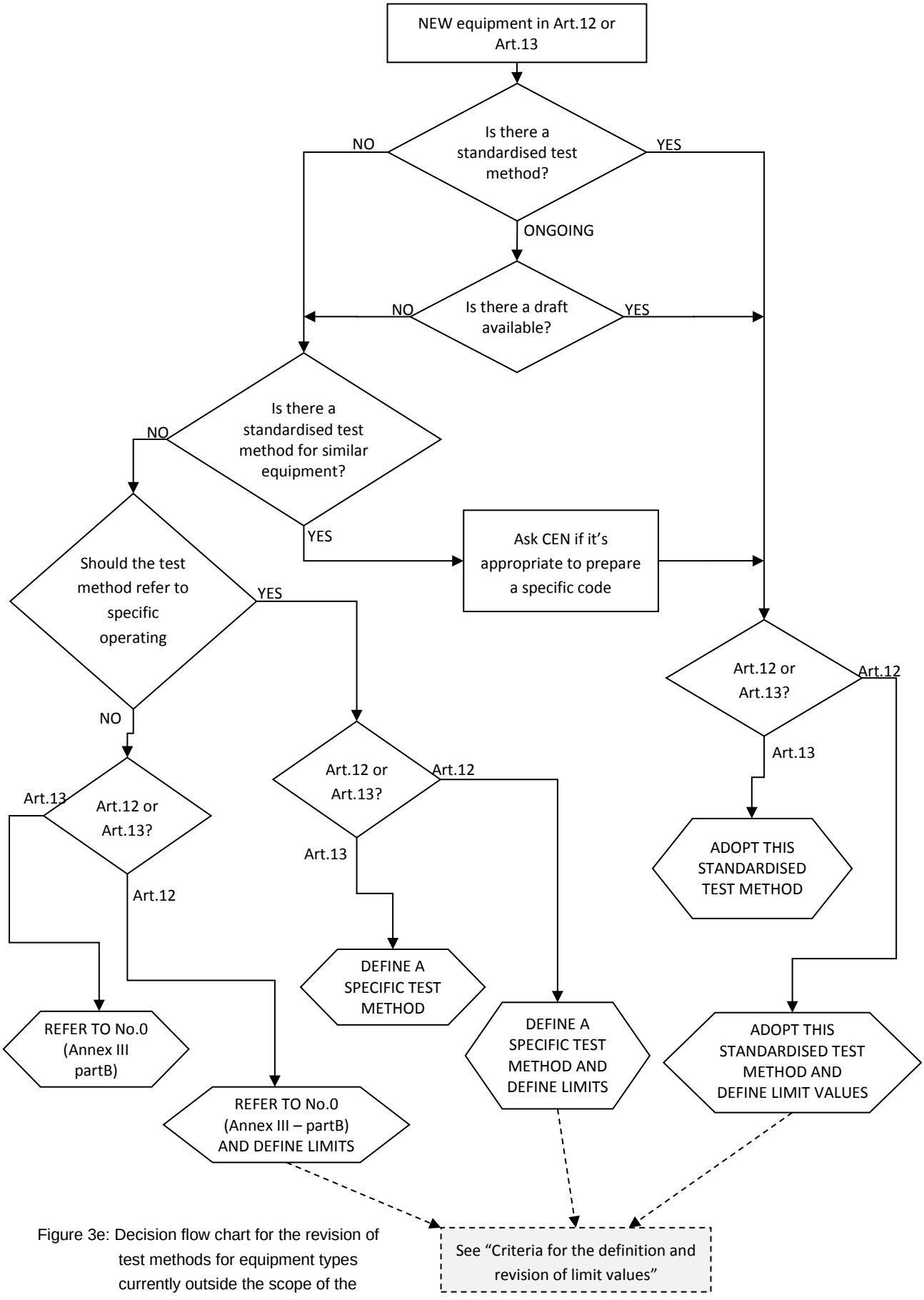

Figure 3e: Decision flow chart for the revision of test methods for equipment types currently outside the scope of the Directive (Task 4).
For criteria see box in section on Methodology/Main analysis.

2.4 Environmental impact

The environmental impact can be numerically assessed with the EI indicator proposed in the Nomeval study. The description of this indicator is given in Appendix B together with a graph of the results for the estimates made in 2007 and the new estimates for 2015, both for the existing equipment in the OND and for the potential new equipment types.

Although this methodology could be improved on, it would require separate study whilst it is essential to be able to compare new EI values to previous ones. Other methods might result in a different ranking, but as shown in the Nomeval study, this method does seem to be reasonably consistent with annoyance mentioned by the municipalities and NGOs.

The environmental impact indicator EI is purely a means of ranking the equipment and takes into account:
- the average sound power level in typical usage conditions, taken as the average guaranteed sound power level;
- numbers of machines in service for each characteristic area of usage;
- usage times and duration;
- penalties for tonal, impact or fluctuating noise and for night time usage
- numbers of affected people in each type of situation.

A difference in any of these input parameters can cause a change in the resulting EI value. The environment types and noise distributions for each environment situation type remain fundamentally the same as in the Nomeval study and are not repeated here.

The environmental impact is assessed for a wide as possible group for each equipment type. Assessing small subgroups of equipment is not meaningful as they will tend to have low impact.

Typical values for the environmental impact indicator vary between 20-80 dB(A) and are classified from very low to very high as listed in table 1 below.

Table 1: Rating ranges of the Environmental impact indicator as used in the Nomeval study.

Rating	Range of environmental impact indicator EI in dB
Very low	<37
Low	37-46
Medium	47-56
High	57-67
Very high	>67

The borderline criterium for changing or introducing limits is between low and medium, so equipment just above or just below 47 may give rise to discussion.

In assessing equipment population for each type, these were updated where new information sources were available. This was done by one or more of the following:

- Existing population estimates such as the EU Commission report on Evaluation of Internal Market Legislation for Industrial Products [33];
- Market data sources including annual sales data combined with product life estimates;
- Numbers of noise declarations, which are generally in the hundreds for mass-produced consumer equipment;
- Visible market presence as a mass product, as found on internet and widely available in hardware stores and supermarkets;
- Comparison between equipment types, i.e. common and frequently used consumer equipment often sold in the millions in the EU;
- Other methods including numbers of inhabitants, ownership per head of population or per number of dwellings.

2.5 Technical feasibility

Technical feasibility is based on evidence from databases, available product information as found on the internet and market availability of technology in the equipment concerned. It should look beyond the current situation given the timescale of new regulation.

2.6 Issue of timescale

It is currently foreseen that any new regulation would not come into force before 2021, and given that the current directive did not change since 2005, future changes might not occur for another ten years after 2021. This means that limit proposals should look further than the current situation in anticipation of ongoing technical developments.

2.7 Economic feasibility

Economic feasibility is determined by the amount of additional manufacturing, R&D and testing costs and costs rising from product ranges being taken off the market or modified. It also strongly depends on the time available for product development and the availability of technology to fulfil the requirements. Also the extent to which SMEs may be affected should be taken into account. As there are many SMEs producing equipment covered by the OND, it should be assumed that there will nearly always be an impact on these companies. However, in many of the recommendations in this study, this is taken into account when proposing new limits, which are often less strict than previous proposals and are underpinned by evaluation of database pass rates, where possible.

2.8 Definition of equipment in the scope of the directive

The definition of equipment belonging in the scope of the directive is given in articles 1,2 and 3, and is clearly important in considering including new equipment types. It is listed here for reference:

Art 2(1). This Directive applies to equipment for use outdoors listed in Articles 12 and 13 and defined in Annex I. This Directive only covers equipment that is placed on the market or put into service as an entire unit suitable for the intended use.

Non-powered attachments that are separately placed on the market or put into service shall be excluded, except for hand-held concrete-breakers and picks and for hydraulic hammers.

Art 2(2). The following shall be excluded from the scope of this Directive:
— all equipment primarily intended for the transport of goods or persons by road or rail or by air or on waterways,
— equipment specially designed and constructed for military and police purposes and for emergency services.

Art 3(a). 'Equipment for use outdoors' means all machinery defined in Article 1(2) of Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery which is either self-propelled or can be moved and which, irrespective of the driving element(s), is intended to be used, according to its type, in the open air and which contributes to environmental noise exposure. The use of equipment in an ambience where the transmission of sound is not or not significantly affected (for instance under tents, under roofs for protection against rain or in the shell of houses) is regarded as use in the open air. It also means non-powered equipment for industrial or environmental applications which is intended, according to its type, to be used outdoors and which contributes to environmental noise exposure. All these types of equipment are hereinafter referred to as 'equipment'.

2.9 Equipment grouping

In the current 2000/14 directive, there is no distinct grouping of equipment other than in terms of Article 12 or 13, the noise limits and the equipment power ranges.

For the purpose of modified or new noise limits, it could be an option to separate the equipment in terms of powertrain type (especially CE or electrically powered), consumer and professional use or even by market sector.

In the proposals made in this study, distinctions are made for
- CE-powered and electric equipment
- CE-powered and other equipment
- Sub-ranges of technical parameter, which are related to distinct market or technical groups such as consumer and professional, handheld/walk-behind/ride-on. These groups can be quite machine-specific and are often visible in declared data in the databases.

3 Review of source documents and data

3.1 Directive, amendments and guidelines

The current noise limits for Article 12 equipment are listed in the 2005/88/EC directive, shown in table 2 below. Explanatory information on application of the OND and technical parameters can be found in the Guideline to the directive [3] .

3.2 Links with other directives

The 2000/14 directive (OND) has a number of links with other EU directives, which may directly or indirectly have an effect on technical progress or other aspects such as market situation or economic impact. The Environmental Noise Directive 2002/49/EC actually refers to the OND, however without detailing the connection, which could be assumed to be industrial noise.

All these directives [21-32] are listed together with the aspects concerned in table 3, and described in more detail in Appendix A.

Table 2: Current limits as specified in directive 2005/88/EC.

Type of equipment	Net installed power P (in kW) Electric power P_{el} (1) in kW Mass of appliance m in kg Cutting width L in cm	Permissible sound power level in dB/1 pW	
		Stage I as from 3 January 2002	Stage II as from 3 January 2006
Compaction machines (vibrating rollers, vibratory plates, vibratory rammers)	$P \leq 8$	108	105 (2)
	$8 < P \leq 70$	109	106 (2)
	$P > 70$	$89 + 11 \lg P$	$86 + 11 \lg P$ (2)
Tracked dozers, tracked loaders, tracked excavator-loaders	$P \leq 55$	106	103 (2)
	$P > 55$	$87 + 11 \lg P$	$84 + 11 \lg P$ (2)
Wheeled dozers, wheeled loaders, wheeled excavator-loaders, dumpers, graders, loader-type landfill compactors, combustion-engine driven counterbalanced lift trucks, mobile cranes, compaction machines (non-vibrating rollers), paver-finishers, hydraulic power packs	$P \leq 55$	104	101 (2) (3)
	$P > 55$	$85 + 11 \lg P$	$82 + 11 \lg P$ (2) (3)
Excavators, builders' hoists for the transport of goods, construction winches, motor hoes	$P \leq 15$	96	93
	$P > 15$	$83 + 11 \lg P$	$80 + 11 \lg P$
Hand-held concrete-breakers and picks	$m \leq 15$	107	105
	$15 < m < 30$	$94 + 11 \lg m$	$92 + 11 \lg m$ (2)
	$m \geq 30$	$96 + 11 \lg m$	$94 + 11 \lg m$
Tower cranes		$98 + \lg P$	$96 + \lg P$
Welding and power generators	$P_{el} \leq 2$	$97 + \lg P_{el}$	$95 + \lg P_{el}$
	$2 < P_{el} \leq 10$	$98 + \lg P_{el}$	$96 + \lg P_{el}$
	$10 > P_{el}$	$97 + \lg P_{el}$	$95 + \lg P_{el}$
Compressors	$P \leq 15$	99	97
	$P > 15$	$97 + 2 \lg P$	$95 + 2 \lg P$
Lawnmowers, lawn trimmers/lawn-edge trimmers	$L \leq 50$	96	94 (2)
	$50 < L \leq 70$	100	98
	$70 < L \leq 120$	100	98 (2)
	$L > 120$	105	103 (2)

(1) P_{el} for welding generators: conventional welding current multiplied by the conventional load voltage for the lowest value of the duty factor given by the manufacturer.
P_{el} for power generators: prime power according to ISO 8528-1:1993, clause 13.3.2

(2) The figures for stage II are merely indicative for the following types of equipment:
- walk-behind vibrating rollers;
- vibratory plates (> 3kW);
- vibratory rammers;
- dozers (steel tracked);
- loaders (steel tracked > 55 kW);
- combustion-engine driven counterbalanced lift trucks;
- compacting screed paver-finishers;
- hand-held internal combustion-engine concrete-breakers and picks (15<m<30)
- lawnmowers, lawn trimmers/lawn-edge trimmers.

Definitive figures will depend on amendment of the Directive following the report required in Article 20(1). In the absence of any such amendment, the figures for stage I will continue to apply for stage II.

(3) For single-engine mobile cranes, the figures for stage I shall continue to apply until 3 January 2008. After that date, stage II figures shall apply.

The permissible sound power level shall be rounded up or down to the nearest integer number (less than 0,5, use lower number; greater than or equal to 0,5, use higher number)'

Table 3: Overview of other directives with direct or indirect links to 2000/14/EC.

Directive	**Aspect relevant to 2000/14/EC**
Machinery Directive 2006/42/EC (Essential safety requirements for machinery)	Noise level at operator positions to be registered in instruction manual; if above 80 dB(A) then also sound power level; design and construct to reduce risks from noise to the lowest level, taking account of technical progress.
Physical Agents Directive 2003/10/EC (Exposure of workers to noise)	Noise exposure limit value of 87 dB(A) over 8 hours is set for worker, together with upper and lower action level values of 85 and 80 dB(A) respectively.
Exhaust Emission Directive for Non-Road Mobile Machinery 97/68/EC and amendments 2002/88/EC, 2004/26/EC, 2006/105/EC, 2010/26/EU, 2011/88/EU, 2012/46/EU.	Emission of gaseous and particulate pollutants of engines for Non-Road Mobile Machinery, indirectly affecting noise via cooling requirements and engine control.
EU Regulation no. 167/2013 on the approval and market surveillance of agricultural and forestry vehicles and Delegated Regulation (EU) 2015/96.	Limits for maximum sound pressure level during acceleratiing pass-by and measurement method. Relevant as tractors also operate in construction and maintenance in urban areas.
Regulation 540/2014/EU on the sound level of motor vehicles and of replacement silencing systems, amending Directive 2007/46/EC	Noise limits for road vehicles. Some outdoor equipment is powered by the vehicle engine.
Regulation 168/2013/EU on the approval and market surveillance of two- or three-wheel vehicles and quadricycles	Noise limits for mopeds, motorbikes and quads affecting engine technology, some similarities to outdoor equipment with IC engines.
Environmental Noise Directive 2002/49/EC (END)	Noise mapping and action planning for roads, railways, airports and industry. Reference to 2000/14.
Directive 2009/125/EC on Ecodesign requirements for energy-using products (EUP).	Energy consumption of energy-using products, including noise limits for Airco and heat pumps, potentially other products to follow.
2012/19/EU on Waste Electrical and Electronic equipment (WEEE)	Material choice and design of electrically powered equipment.
1907/2006/EC concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)	Types of materials or lubricants applied in outdoor equipment.

3.3 Nomeval report (2007)

In 2007 the NOMEVAL study [6] was performed by the TNO/TÜV Nord/VCA/LNE consortium for DG Enterprise to evaluate the effectiveness of the Directive and the possibility of lowering noise limits, introducing new ones and adding new equipment

types. The study had a broader scope than the current one and included a stakeholder consultation, an impact assessment and wider evaluation of the directive including market surveillance, conformity and recommendations for further investigation.

The study provided a detailed list of proposals and datasheet for each equipment type. A methodology was developed and applied for assessing the criteria of environmental impact, technical and economic feasibility. A decision flowchart was used to assess each equipment type, so as to properly document the rationale behind each recommendation. Test methods were reviewed in relation to their applicability and current status. These elements and approaches are adopted here in a similar manner, improved or streamlined where necessary.

The EU database was analysed at the time, although there were some limitations due to lack of data or incorrect data for some machine types.

3.4 Arcadis impact assessment study (2009)

A further detailed study was performed in 2009 by Arcadis [7] including a market consultation and a separate impact assessment study on conformity of SMEs [8].

The impact assessment study was performed on eight clusters of equipment types, specifically:

- Cleaning equipment
- Construction machinery
- Gardening equipment
- Loading and lifting equipment
- Power generators and cooling equipment
- Pumping and suction equipment
- Snowmobiles and snow groomers
- Waste collection, processing and recycling equipment.

Three scenarios were compared:
I) baseline scenario: leaving the Directive as it is,
II) the NOMEVAL study proposal
III) the WG7 position paper proposal

providing detailed information on economic, social and environmental impacts using indicators similar to those used in the Nomeval study. The study did not recommend (or aim for) one particular scenario but set out the impacts for each product cluster.

A further scenario was also defined for snowmobiles, based upon the proposals of snowmobile manufacturing industry and the US standard.

The findings were as follows:

Rather negative, negative or very negative economic impact combined with a neutral or negative environmental impact was found for:
30 (joint cutters) for scenario II (but not III),

119 (stone circular saw), both for scenario II and III,
2 (brush cutters), both for scenario II and III,
25a (hedge trimmers) both for scenario II and III,
32d (lawnmowers), both for scenario II and III,
6a (portable chain saws) for scenario III,
15 (cooling equipment on vehicles) for scenario III,
29b (hydraulic power packs) both for scenario II and III,
57b (welding generators) both for scenario II and III,
57c (welding generators) for scenario II,
52 (suction vehicles) for both scenario II and III,
56aa and 56ab (waterpumps) for both scenario II and III,
56ba and 56bb for scenario II,
22 (glass recycling containers) for both scenario II and III.

No cases were identified with a rather positive, positive or very positive environmental impact with a neutral (or positive) economic impact.

The following cases were found with a very positive environmental impact with an (at worst) rather negative economic impact:
17aa (drill rigs) for scenario II,
17ba (drill rigs) for both scenario II and III,
42b (piling equipment) for scenario II,
48a (road milling machines) for scenario II,
8ca, 8cb and 8cc (compaction machines) for scenario II,
115a (telescopic pruner) for scenario II,
115b (telescopic pruner) for scenario II,
32b (lawnmowers) for scenario II,
57a (welding generators) for scenario II.

In other words, there is nearly always some additional cost for compliance incurred as a consequence of amended legislation. Also, each scenario can only be assessed per equipment type.

The impact assessment study on conformity of SMEs [8] had the following objectives:
- carry out a detailed assessment of the specific impacts on SMEs of some specified policy options related to the revision of the Noise Directive;
- to carry out an Impact Assessment Study on policy options concerning the replacement of the conformity assessment procedure (CAP) of the existing Annex VI of the Noise Directive by module A2 , and module B in combination with module C of Decision 768/2008/EC (common framework for the marketing of products).

A consultation was carried out, but relatively few SMEs were identified and the response was low.

The most important policy conclusions are the following:
- Even if all companies would face the cost disadvantages of SMEs, the outcome of the cost-benefit analysis of Nomeval and the MCA of the impact assessment study would not be affected fundamentally, except maybe in the case of aerial access platforms.
- The most important disadvantage faced by SMEs is the high share of fixed costs

(including those related to regulatory compliance) compared to variable costs.
- In total, employment in SMEs affected by the Directive does not exceed a few thousand units at the European level. The information gathered during the study does not suggest that a significant proportion of these jobs are actually threatened. In most cases, the SMEs affected by the Directive are located in regions with lower than average structural unemployment.
- Some SMEs have also reported difficult access to capital markets and weak negotiating position towards suppliers and industrial clients as a problem. However, these problems are not caused by the Noise Directive, and the solutions for these problems lie in different policy areas (financial markets policy and competition policy).
- In the case of snowmobiles, the only SMEs affected are dealers and the professional end users. The actual impact depends crucially on how snowmobile producers will react to noise limits.
- Spreading the introduction of more stringent noise emission limits over time would help SMEs to overcome the bottlenecks in their R&D capacities.
With respect to the CAP, the most robust findings are that:
- As far as the environmental effects are concerned, the actual choice of the CAP is of secondary importance, and market surveillance is the real key.
- The New Legislative Framework is not well known.

This study would seem to indicate that the impact on SMEs is minimal especially if sufficient time is available for them to adjust to new limits.

3.5 WG7 Paper (2010)

The most recent consolidated document with noise limit proposals is the position paper developed by Working Group 7 in 2010 [9], which combined the conclusions of the Nomeval and Arcadis studies with input from the industry stakeholders. The WG7 paper is the starting point for the assessment as it was based on the most current stakeholder input at the time. The WG7 paper was based on the following criteria:

- Maintain the present situation for most types of equipment now listed in Article 12 subject to Stage II permissible levels.
- Make all Stage II indicative permissible levels compulsory unless specific reasons indicate otherwise.
- Move all Article 13 equipment to Article 12 where relevant data are sufficient and plausible, except if process noise is dominant such that lowering of the noise emission under test conditions would not result in an equivalent reduction in real life.
- For most changes from Article 13 to Article 12, two successive stages of noise permissible levels are proposed. In addition, where appropriate, a division into groups of machinery according to certain parameters (in general engine power) is proposed, to reflect the impact on noise emissions in populated areas where in particular consumers are likely to use those machines.
- Removing equipment from the Directive only where appropriate, i.e. only where it has disappeared from the market and environmental benefit and legislative harmonisation is not lost.

- New equipment is included if it fits under the definitions in Article 2 of the directive and only if not for use in areas or plants regulated by local noise permits.
- Equipment definitions are updated following technical progress and the experience of application of the Directive.
- The measurement method and conditions of UN ECE R120 shall be used for the definition of power of internal combustion engines.
- Test cycles remain the same as now in the Directive unless otherwise specified. Any new test cycle, in order to qualify for consideration, shall be accompanied by complete justification including proof that the new proposed test cycle is available and it guarantees clear advantages compared to the old one, mainly in terms of repeatability and reproducibility. Further to that, a correlation of the measured values obtained with the old and the new test cycles is necessary for consideration of a test method change proposal. Whenever possible reference to international standards is made.
- When two successive new stages are suggested, in general they should be spaced 4 years from each other (as in the Directive).

3.6 Current databases

Four current databases were provided for this study, containing registered noise declaration data from recent years. These include:

- The EU NOISE database, made available by the Commission;
- The Italian MARA database, made available by ISPRA;
- The UK NMRO database, made available by NMRO;
- The Dutch MIA/VAMIL database, provided by the agency RVO.

Analysis of these databases is presented in Appendix C and E. Most, but not all, equipment types are present in the databases and some are under-represented. A portion of the data does not include a value for the technical parameter in which case it is omitted from the analysis for equipment with power-dependent limits. The EU database contains 27800 records for the period 2000-2015 of which 8245 records over the period 2007-2015. The MARA database contains 5058 records over the past 3 years. The UK database contains 13209 records, with 5415 records for 2007-2015 The MIA/VAMIL database contains only equipment types included in the MIA/VAMIL list. It contains 1322 records over the period 2009-2015.

3.7 Stakeholder inputs

New documents provided by stakeholders since 2007, in particular since 2014 are listed and reviewed here. These have mostly been provided in the Noise Expert Group (NEG) but also as direct input to the ODELIA study in 2015 in response to a request letter sent to NEG members, industry stakeholders, authorities, and NGOs including noise abatement societies. In addition, meetings were held and further information exchanged in September-October 2015 between industry associations including ORGALIME, CECE, EGMF, FEM, Europgen, EUnited Cleaning, EUnited Municipal Equipment, ISMA, EPTA and PNEUROP. Most of these provided additional background data relating to their specific equipment types.

NGOs
Some NGOs responded to the request letter which was sent to several national noise abatement societies and environmental organisations.

In the Netherlands, the following sources of disturbance were mentioned by the Dutch Noise Abatement Society (NSG) [34] :

- Noise from construction sites, which is regulated by maximum daytime exposure levels, limiting the maximum number of days depending on the noise level; not only the noise level but in particular the operating times are an issue;
- Noise from leafblowers, often considered too noisy and unnecessary, see for example the website www.bladblazen.nl;
- Noise from generators used by water vessels while moored, both for professional and private use; small generators particularly at recreational locations such as yacht harbours and holiday homes;
- Various types of street cleaning equipment used for tidying after events and markets in town centres, especially in the early hours, including blowers and sweepers;
- Irrigation of fields, often powered by tractors with attached pumps.

Gas gun issue in the UK – B-ooom Campaign group
A particular issue was put forward by the UK campaign group B-ooom [39] concerning the use of gas guns (bird scare cannons) as these cause severe disturbance to nearby inhabitants. Although this should be covered by local regulation it is apparently not effective for a variety of reasons. Local regulation should cover noise levels, operating times, distance to dwellings and potentially include a ban on use especially if alternative technical solutions are available. B-ooom suggests that the Gas guns fit into the current scope of the directive and request that they be included.

Authorities
UBA proposal
The German Environmental Agency UBA put forward a proposal [36] to create multiple regulations, covering at least the following different product groups:
1. Cleaning, pumping and suction equipment
2. Construction equipment
3. Gardening equipment
4. Loading and lifting equipment
5. Power generators and cooling equipment
6. Waste collection, processing and recycling equipment.

Potential advantages of this approach could be:
• Separate and therefore more detailed discussions with only the specific (industry) stakeholders.
• Future attempts of changing regulated content, e. g. including new products or setting new noise limits, would not affect any part of the regulation.
• Faster response to technical developments or new technology.

UBA also mentions that the noise emission of some equipment types which are listed as new equipment are already covered in other directives and regulations and therefore should not be put into the OND. These are numbers 100 air conditioning units, ventilation and 101 Heat pumps included in the Ecodesign Directive

2009/125/EC and number 109, tractors in EU Regulation 167/2013. The Ecodesign Directive 2009/125/EC is a framework directive with general definitions. Individual equipment types are covered in EU regulations. So for example, the Regulation 206/2012 sets maximum sound power levels for air conditioning systems and comfort fans.

The UBA proposal of a framework directive and subdivision into regulations for different product groups would also be a meaningful approach for the OND. Amendments to test codes or limit values for single equipment types could be introduced far more easily and quickly.

UBA also states that there is an increased interest in noise information both for public procurement and for consumers. If this were to be made mandatory it would be beneficial to all parties with negligible costs.

Belgian studies on chainsaws and shredders

Several studies have been undertaken or commissioned by the Belgian Federal Authority on Public Heath, Food chain safety and Environment (FOD) including a round robin test on chainsaws [13], studies on inconsistencies in the test methods for chain saws [14,15] specific proposals for noise limits for chainsaws [16] and noise classification of shredders [17]. These studies provide a good basis for proposals for noise limits and improvements to the test method. The study on shredders provides an overview of noise data and the technical progress resulting in quieter machines.

Position paper from the Netherlands

The Netherlands Ministry of Infrastructure and Environment submitted a paper on potential changes to noise limits [37] . In the Netherlands, the so-called MIA/VAMIL incentive allows tax relief on investment in new machinery that performs well below EU noise limits and other environmental criteria. As a consequence, there is up-to-date information on numbers of some machine types that easily fulfil the limits and potential margins for adjusting limits in the Directive. A table of potential limit changes based on this data is given in Appendix E, table E1, for types included in the MIA/VAMIL list and with a compliance rate of 90% and 75%. This data only refers to machine types included in the MIA/VAMIL list and is therefore not exhaustive. Other machine types in the Directive may also have scope for limit adjustment. The full MIA/VAMIL list with noise limits is given in Appendix E, table B2. Some of these machines are currently still in Article 13 of the Directive.

VNG

The Dutch Association of municipalities VNG provided the following initial statements to the ODELIA study (email communication [40]):

- The regulations should be tightened by linking the noise emission levels of the machine to frequency bands, in particular those critical for annoyance or hearing damage. By tackling these frequencies, quality of sound insulation and reduction of engine noise e.g. by mufflers can be increased.
- Stricter or new limit values: need for EU regulations that low noise piling equipment (indicated by the sound power level) should be used within a certain distance to dwellings. Or, preferably, make use of quieter piling equipment mandatory, unless the area is not noise sensitive.

- Reduction of machinery vibrations is also a point of attention for piling machinery, heavy road vehicles including tractors transporting earth, vibratory plates for paving and road milling machines for asphalt removal.
- Priority should be given to reduce noise from machines frequently used in gardens and can cause neighbour disputes, such as leaf blowers and mowers.
- Problems occur especially with petrol engine powered high rpm brush cutters and leaf blowers. The varying engine speeds and the use of 2-stroke engines makes these very tiring to hear. Application of well-silenced 4-stroke engines would be desirable, or better, to make usage of modern battery technology obligatory, taking the petrol engine out of the picture.
- A health label for hearing (for the private user) is recommended instead of tackling particular frequency bands. An accompanying measure could be that for a certain label the manufacturer should also provide the appropriate hearing protection (adapted to the particular noise characteristics) free of charge. This would then benefit both the user and affected nearby residents.

Eurocities

Eurocities, the European network of major European cities, responded to the ODELIA request letter supporting the VNG position and in addition mentioning the following points [41] :

A lot of annoyance and complaints are observed from

- Rammers
- Leaf blowers
- Glass recycling containers
- Scarifiers *(Note: possibly stone scarifiers or vibratory plates are meant)*
- Chippers/shredders
- Chain saws
- Hydraulic hammers
- Lawn mowers

(*Most of*) These machines are currently under the labelling mechanism of directive 2000/14/EC and to the opinion of Working Group Noise it seriously should be considered to set noise limits for these machines. In general we have noticed that machines that are used in green keeping of public places and private places are rather noisy. This is also the case when observing machines used during construction works (e.g. concrete breakers, excavators, paver-finishers, hydraulic hammers, etc.).

One of the omissions in directive 2000/14/EC is that nothing is mentioned about enforcement or inspection of machines in use.

Icelandic Association of Local Authorities

The Icelandic Association of Local Authorities indicated the following [94] :

1. All the mentioned machinery are important for noise disturbance, in particular construction machinery. In Iceland the ground for buildings ans other structures is very often the bedrock since the soil cover is very thin. This more often creates noise problems on the surface than if the working environment were on soft ground layers.
2. There are no specific proposals for noise emission limits for the time being, but there is work in progress and such limits would be put forward in the near future. It would however be helpful if proposals for such noise limits could be communicated as well as existing noise limits for machinery.

Industry

ORGALIME

ORGALIME, the European Engineering Industries Association submitted a position paper [42] in response to the ODELIA draft interim report, concerning horizontal issues applicable to all sectors. Regarding the criteria for new limit values, ORGALIME states the need for individual assessment of each equipment type separately under proper conditions and with valid justifications; ORGALIME believes that the environmental impact assessment should be the first criterium for limit proposals and not the relevance of noise problems or concerns in one member state (as indicated in the decision diagrams). Concerning technical feasibility, ORGALIME considers that all the available data used should be reliable. On subsidiarity and proportionality, stringent local regulations should not be used as a basis for reviewing the whole set of limit values at EU level, which are supposed to be minimum requirements. For this reason, ORGALIME suggests that the decision diagrams be modified, putting the environmental impact at the top of the diagram.

Note: In this study, the environmental impact is performed in all cases and the issue of member state requests is mainly relevant for the snowmobiles.

ORGALIME also requests to reconsider the values of the environmental impact indicator above which limits are proposed.

Note: The EI approach and these values are still considered reasonable given the correspondence with complaint information demonstrated in the Nomeval study. Alternative approaches may well be feasible but it is beyond the scope and means of the ODELIA study to elaborate further on this. It would also complicate the comparison with Nomeval results.

ORGALIME also requested clarification of the 'Low relevance' box in the decision diagrams. *This has been done.*

On test codes, ORGALIME recommended reviewing the test codes with the sectors involved and using European or international standards when available, given the problems such as equipment definitions, measured quantities in relation to reality and modifications of operating conditions.

ORGALIME criticises the use of the European database as it is known to contain errors and therefore does not consider it a valid tool. It is suggested to contact the various sectors concerned to gain a clear picture of the real noise limits that are set in the sectors.

Note: In the ODELIA study the database contents have been evaluated, eliminating erroneous data as far as possible in cooperation with industry stakeholders, and checking the feasibility of the data against other sources such as internet and for Article 12 equipment, the data positioning relative to the limits (good examples are lawn mowers, generators and compressors).

ORGALIME requested to also take the broader regulatory context and agenda into account, given that many legislative tools have been developed in relation to noise reduction, causing potential overlap. Specific reference is made to

- Environment Action Programme to 2020 [20]
- Environmental Noise Directive 2002/49/EC [23]
- Machinery Directive 2006/42/EC [21]
- Eco-Design Directive 2009/125 for energy-using products [29]

It is questioned whether further investment into noise reduction is justified.

Note: This has been done by mentioning all the other relevant directives and by explaining the relevance of noise limits for all sorts of sources in relation to national regulation and EU regulation for noise at the receiver. The arguments for the need for noise reduction are clearly stated in this study. No other directives actually set noise limits for outdoor equipment listed in the OND.

ORGALIME recommends not to add further environmental requirements through the Outdoor Noise Directive as many of these are already included in the broader package tabled by the institutions in other directives or programmes. The market surveillance authorities' enforcement of current noise provisions would be a more appropriate robust approach.

ORGALIME recognises that in some sector specific areas, the ODELIA study will not have all the relevant data to decide whether the limit values have to be amended. They therefore recommend close cooperation with the sectors involved so that any methodology chosen and any new limit values applying to existing or new equipment takes into account all the parameters (economic, environmental, technical and social), thereby allowing EU companies to remain competitive, without adding further burdens to place products on the market.

ORGALIME also recommends that any future new limit values should clearly be technically feasible and should take into account the investment cycles of European companies in order to allow them first to recover the investment that they have made to develop and market the innovative products that are available today and then to carry out the necessary R&D and product development to attain where possible feasible, solutions which cover all product specifications expected by customers and regulators alike.

EGMF

The European Garden Machinery Federation EGMF has provided a position paper in 2015 on the revision of the Directive [43]. In relation to noise limits the main points EGMF puts forward are the following:

- Not to tighten the noise limits applicable to products currently in Article 12.
- A reduction would adversely affect the machine's ability to deliver an efficient and effective service. A primary consequence is that the machine is likely to be used longer in order to compensate for the reduced performance, which in turn would lead to a longer exposure time to noise and exhaust emissions.
- Integrating the effects of reproducibility into the calculation of the k factor has resulted in a reduction in the measured noise, in order to fulfil the limit value for the guaranteed noise level.
- Maintain the current classification split between products for which fixed noise limit values apply and products that need only to be labelled.

In response to the ODELIA request letter, EGMF also provided a more detailed document addressing each of the questions [44]. This is summarised below.

For electrical products the introduction of battery powered machines is increasing but still limited in volume and performance (lower usage time and higher costs), process noise is the same whatever the energy source.

For combustion engines the continuous reduction of exhaust emission levels due to the Directive 97/68/EC [24] and its amendments has had and will have (EU stage V) an adverse effect on noise levels as it slightly increases the noise levels and also deteriorates the sound quality perception. In general, there have been large investments on R&D in time and resources but so far no significant reduction has been achieved. No technical advance is foreseen regarding the working process for most gardening equipment. In addition, if noise limits are lowered or new limits are introduced there is likely to be:

- a significant performance reduction and conversely resulting in a significant increase in usage time;
- a significant increase in development and investment costs in order to redesign product ranges and make them compliant;
- a need to significantly increase resource capacity (head count) and extend project times i.e. impact on time to market;
- a significant increase in product cost to the consumer which is likely to drastically reduce sales.

Engine and motor cooling requires openings to let air come in and cool the hot parts. This requirement is contradictory with noise reduction. Restricting cooling airflow to reduce noise will increase engine and motor temperatures thus creating a higher risk of overheating and a big concern for fire hazards due to the accumulation of lawn clippings in areas of elevated temperature.

Engine Emission Regulation EU stage V adversely affects noise. Internal Combustion engines need to have improved combustion characteristics to meet the future emission regulations.

The OND should not be technology oriented and not restrict any innovative design. European legislation should be technology neutral.

Process noise should not be used as a reason to include a product in the OND or in order to reduce any noise limit already present. The motion of the working elements of the machine has a major influence on noise and cannot be lowered without losing the performance. Additionally, new technologies and new parts will always increase the weight which is a critical factor for handheld machines. Increased weight will generate higher operator fatigue and consequently higher risks of accidents. It will also increase the likelihood of repetitive strain injuries.

SMEs are represented in the following OND categories for EGMF: grass edge trimmers, lawnmowers, brush cutters, chainsaws, scarifiers, shredders, tillers/motor hoes, lawn trimmers, leaf blowers and collectors, sweepers.

EGMF had 29 member companies in 2015. From EGMF sales figures, and an EU study on Ecodesign, relative numbers of gardening equipment could be estimated relative to lawnmowers, allowing to provide updated input to the environmental impact. It was found that numbers of handheld equipment was significantly higher than estimated in the Nomeval study, in the tens of millions in some cases.

ISO 3744:1995 referenced in the OND has been withdrawn and replaced by ISO 3744:2010. This has resulted in the positions of certain measurement microphones being modified, placing them closer to the noise source. When introduced , this will result in higher measured values requiring manufacturers to lower the actual noise emitted by machines to pass the limits, if any.

For most equipment such as lawnmowers, brush cutters, cut-off saws, shredders, blowers and others, tool and process noise is often dominant and hard or impossible to reduce. Parameters are:
• Speed of engine and tool: Higher speed will lead to shorter usage time but to more noise;
• Performance / Cutting Efficiency: Higher engine performance will lead to shorter usage time but to more noise;
• Covers: Smaller covers will lead to reduced weight, better cooling but more noise;
• Cooling air: More cooling air will lead to less wear, but to more noise;
• Gearing: Used to transform engine speed, or to drive tool which creates noise but cannot be taken away;
• Structure- borne noise: Less mass of the engine will lead to less absorption, less weight but to more noise.
Many different sources of comparable strength are present including engine with intake and exhaust, airflow, gear transmission, cutting or blade noise. In addition other design parameters have to be fulfilled including weight, emission, performance and costs. The complexity of noise reduction is therefore considered very high.

EGMF emphasises that further noise reduction on lawnmowers is extremely difficult due to many limiting factors including
- emissions requirements resulting in hotter engines and increased cooling needs;
- process noise from the blade which can only be reduced at a loss of performance.
Reference is made to the Lamonov report [12] on lawnmower noise in which the importance of blade noise is demonstrated and the difficulty to reduce it further.

Further information is provided from 2007 including critique of the Nomeval recommendations and indicating the introduction of limits for these equipment types is not feasible.

Finally, EGMF provided papers in response to the draft intermediate report [45] and to the draft final report [46]. EGMF made some limit proposals for several equipment types which are referred to in the chapters on limit proposals. Main points for the final report were:
- to point out where test codes are amended;
- consistency of environmental impact values;
- terminology of flowcharts;
- any new equipment should only be in Article 13;
- only adopt first stage limits from WG7 paper, as two steps at once are not considered possible;
- CENELEC should also be involved in relation to standards for electrical equipment;
- other equipment specific points, addressed in the relevant sections in this report.

CEMA

CEMA, the European Agricultural Machinery Association submitted a document [47] explaining their reasons not to support the introduction of noise limits for wood chippers and shredders. These are the following:

- Variety of chippers and shredders on the market for different purposes;
- Some of the noisier equipment can handle larger materials and faster, unlike the quieter worm systems which are slower and less suitable for professional use and some other applications;
- Differences in material size and hardness that make it difficult to set uniform noise limits, especially for those machines that can handle larger branches;
- New safety requirements have resulted in longer input channels resulting in more noise;
- Cost of noise reduction;
- Operation times are mostly short and far from dwellings, and slower systems would increase the duration of the noise;
- The mandatory label is considered the right solution to inform customers of noise levels;
- The market for professional wood chippers and shredders is mainly served by European SMEs who have a limited engineering capacity and face more problems complying with European legislation;
- The most relevant noise emission of chippers and shredders is process noise;
- The machines do not emit a lot of noise, but noise levels increase and differ significantly when material is put into the machines;
- Possible problems can arise if noise requirements are introduced too soon after the Stage V exhaust emission limits, which are probably to be introduced in 2019.

In response to the draft final ODELIA report, CEMA provided new comments [48] This included a proposal to differentiate between electric and petrol engine driven shredders below 5 kW as the limit of 109 dB is not considered feasible for petrol engine powered machines, and therefore a higher limit is suggested.
Also for the larger machines a higher limit is suggested to allow for machines that can process large branches.

FEM

The European Materials Handling Federation FEM produced position papers in 2014 [49,50] covering broader aspects of the Directive, and in relation to limits the following points:

- not to reduce competitiveness on external markets;
- to take into account other relevant legislation affecting machinery manufacturers, and in particular Directive 97/68/EC on emissions from engines used in non-road mobile machinery (the revision of which is ongoing) and Directive 2006/42/EC on machinery. Conforming to both noise and exhaust emissions requirements often entails contradictory technical constraints;
- Application dates must take account of the revision of Directive 97/68
- Any modification or new limit value should be applicable only after any new stage introduced by the revision of Directive 97/68
- take into account hybrid machines and work done in the NEG
- Equipment 1: Aerial access platforms: Rename as “mobile elevating work platform” in accordance with EN 280. If this equipment is moved to article 12, limit values need to be reconsidered. The test code needs to be revised to take

into account the real use of the equipment, especially the fact that noise is produced only during the elevating/lowering phase and not during the working phase. FEM will prepare a proposal.

- Equipment 12: construction winches: FEM confirms its request to remove this equipment from the Directive's scope due to the very low number of pieces of this equipment on the market.
- Equipment 14: conveyor belts: FEM confirms the content of the WG7 document.
- Equipment 36: Lift trucks: FEM supports the classification proposed in WG7 document with the following modifications:
  - Lift trucks covered by Article 13: for lift trucks under Article 13, the test code should take into account the idle mode and the reference should be EN 12053, which is a harmonised standard for the Machinery Directive.
  - For vertical mast rough terrain and other counterbalanced CE>10 t, the test code should take into account the idle mode and the reference should be EN 12053, which is a harmonised standard for the Machinery Directive. FEM agrees that limit values should be adjusted accordingly. The application of stage II (in the OND) should take place after any new stage introduced by the revision of Directive 97/68.
  - For variable reach lift trucks (telehandlers), FEM is in favour of developing a new test code within the EN 1459 series of standards (e.g. EN1459-X), based on the WG7 proposal. FEM states that limit values should be adjusted accordingly. The application of OND stage II should take place after any new stage introduced by the revision of Directive 97/68. FEM is in favour of excluding telehandlers with tractor type approval used in the agricultural sector, as agricultural equipment is not in this Directive.
- Equipment 38: Mobile cranes: For the test code, it should refer to EN 13000, which is similar to existing test code in Directive 2000/14.
- Equipment 53: Tower cranes: The test code should refer to EN 14439, which is similar to existing test code in Directive 2000/14.
- Equipment 107, 117 & 118: Bridge and gantry cranes, straddle carriers and reach stackers: FEM states that these should not be included, as explained in the WG7 paper.

In June 2015 and subsequently, FEM provided new input Reference [51] to the ODELIA study which is briefly summarised here. Several specific papers in relation to MEWPS, Cranes and Lift trucks were also provided explaining the FEM position [52,53,54,55] followed by some email exchanges [56].

Aerial access platforms/MEWPS are stated to have too low environmental impact to put into article 12. The relevant characteristics with new data relative to 2007 were described, including applied technology, technical and economic obstacle for noise limits and details of the work cycle. The percentages of CE powered machines have decreased since 2007 with currently 50% of booms and 75% of scissors electrically powered. The operating time at high idle is indicated as around 30% of engine operating time with 70% of the time at low idle. With reduced numbers of diesel engines and more electric and hybrid machines, the impact of these machines is expected to decrease. The estimated number of CE-powered machines is around 91 000 in the EU28 for 2015. Total annual engine running time varies between 300 hours for smaller machines to 900 hours for large ones.

For lift trucks it is proposed to keep the current limits and use the new test code.

The share of electric powered forklifts has increased relative to IC-powered lift trucks with the same capacity. Nevertheless, the effect of electrical driven trucks is mainly limited to indoor applications. Forklifts with hybrid drives continue to be developed. From customers who purchase forklifts and mobile container handling equipment, there is very little demand for quieter machines. In very few cases customers request quieter machines in special applications.

The biggest change for diesel powered industrial trucks since 2007 was the introduction of the new stages in NRMM Directive 97/68/EC [24]. This resulted in the use of new generations of engines with exhaust after treatment equipment and particle filter, which require higher engine temperatures and thus more cooling capacity with noisier fans. The foreseen revision of the NRMM Directive (implementation of Stage V) is expected to create even more challenges for noise reduction. Lower maximum engine speed results in lower noise values but has direct effect on performance (acceleration and lifting).

An estimated number of more than 100 SMEs in the EU work in this sector.
The revision of the OND may result in high R&D efforts which are not achievable. There are many small/medium-sized industrial truck manufacturers which produce niche material handling products, such as articulated chassis, lorry mounted, side-loaders, multi-directional, ATEX-applications and others.

FEM also provided a paper [57] with comments on the draft final report which have been taken into account.

CECE
CECE, the Committee for European Construction Equipment, provided besides the previous position papers from 2002 [58] and 2009 [59], preliminary documents in response to the ODELIA request letter covering noise limit proposals [60,61]. They include the CECE positions for the following equipment types:

3. Builders' hoists
8. Compaction machines
13. Conveying and spraying machines for concrete and mortar
16. Dozers (wheeled, rubber tracked, steel tracked)
17. Drill rigs
18. Dumpers
20. Excavators
21. Backhoe-loaders
23. Graders
28. Hydraulic hammers
29. Hydraulic power packs
31. Landfill compactors
37. Loaders
41. Paver finishers
42. Piling equipment
43. Pipe layers
48. Road milling machines
54. Trenchers
55. Truck mixers
102/103. Mobile sieve installations & Mobile waste breakers

The CECE proposals and comments, which are to be considered preliminary, are taken into account in the chapters covering new limit proposals.

Concerning hybrids for vibrating rollers (8a), CECE states:
With the current test procedure (static test with all systems operating at nominal/max rate), no influence is currently measurable, since the engagement of the hybrid-system is measurable currently only at a lower load-set, which represents 80% of operation time, but is not reflected by test methodology. Current models of combustion engine are still equipped with fan and engine for stand-alone operation. Models in future will be equipped with smaller combustion engine and reduced fan diameter and/or a fan with automated speed adjustment, presumably lowering noise emissions during test by 1 up to 2 dB(A) max.

CECE also provided comments on the draft final report which have been taken into account [62]. On key point made is the proposing of limits for equipment with very little measured data.

EUROPGEN
EUROPGEN, the European Generating Set Association, produced a paper in 2015 [63] giving specific recommendations on the effects of setting new noise limits for the three main power ranges of generators (low, medium and high). According to initial studies, tighter limits for smaller generators would affect 75% of the market due to increased sound abatement on open designs and reduce the availability of low cost generators excluding open designs from the market. For large generators stage two noise limit proposals do not appear to consider design trade-offs that would be necessary to deliver gains in the area of noise reduction as resulting negative impact could occur on efficiency, gaseous emissions, product safety, product costs, installation costs and on the existing market and manufacturing industry within Europe.

In a supplemental document EUROPGEN provided a response to the ODELIA request letter in June 2015 [64] The following is stated on technology (summarised).

There are no significant changes in applied technology. The main development in this sector is within the area of engine development, mainly focusing on the reduction of exhaust emissions which sometimes leads to higher noise levels. Improvements have also been made in the area of engine power density, i.e. smaller capacity engines with comparable output power to larger capacity alternatives. The associated reduction in engine block mass can to lead increased vibrations, which in turn can contribute to higher noise levels. Otherwise stated, the positive development in engine power density can contribute to more challenging noise performance of the machine.

A greater range of sound attenuation materials are available, but there has been no notable step change in the effectiveness of such materials for use on generating set products. Such materials must remain durable, weather resistant and fire-proof, which means that it can be difficult to optimise them for sound performance alone.

Understanding of sound performance of generating sets has improved in alignment with demand since the Directive came into force. In some cases investment has

been made by manufacturers to improve in-house testing facilities and equipment. However, in general it is the opinion of EUROPGEN that no significant breakthroughs in sound attenuation have been made in relation to product design.

Focus has been primarily on fine tuning product performance in relation to noise, i.e. optimising generating set designs to deliver compliant sound performance in conjunction with all other design trade-offs rather than specifically targeting noise performance. This approach is primarily due to a relatively low market focus on noise performance when compared to product cost, safety, exhaust emissions and other more critical (as perceived) machine selling points.

Decreases in generating set efficiency are likely to result from reductions in noise limits. Increased sound attenuation reduces cooling airflow, therefore restricting the output of the product. Balancing generating set output per engine capacity vs sound attenuation (and cost) is an issue that commands careful consideration, i.e. when noise limits are further reduced the impact on other eco-design and gaseous emissions initiatives are negatively impacted. It should be considered that moving large generating set equipment from Article 13 into Article 12 presents further challenges to manufacturers. Testing high powered generating sets requires large amounts of fuel and the test facilities are generally outdoors and reliant on good weather conditions. Therefore annual re-validation of noise levels on such equipment is costly and subject to time restrictions, and furthermore involves careful planning and coordination with Notified Bodies who in turn may need to be prepared to cope with an increased and potentially seasonal demand on their services.

Stricter outdoor limits on low power generating sets rated up to 10kWe is technically possible for the latest WG7 proposals, will have a significant cost to consumers and manufacturers. Increasing size and weight of the products to meet stricter noise levels would also impede usability of the products. If the proposals are accepted and imposed it would become critical to enforce them consistently throughout Europe, which would mean much more robust market surveillance than is in place today to ensure fair competition.

EUROPGEN recommends that if stricter noise limit requirements are to be imposed on generating sets ≥ 400 kW then the various applications and considerations for widely different products across this broad (effectively open ended) market should be taken into account, and allowances made where appropriate. All definitions on requirements for large generating set equipment should be explicitly clear as room for differing interpretation could have significant consequences on the intended outcome. The Environmental Impact formula might be one tool through which various applications may be differentiated, however it is recognised that implementation of different noise limits for different applications of the same product could be very difficult to implement in practice.

EUROPGEN provided 2 supplementary papers [65,66] in relation to limit proposals for generators and water pumps in the intermediate ODELIA report.

EPTA

The European Power Tools Association EPTA responded to the ODELIA request letter proposing that the Article 12 definition title “Concrete Breakers and Picks –

hand held" is changed to "Non-electric Concrete Breakers and Picks – hand held" [67]. It is also proposed that a new Article 13 definition title "Electric Demolition hammers and Breakers – hand held" is introduced so that the noise level of these tools has to be declared but they are not subject to limits.
Lower limits would require further lowering of speed with consequential reduction in performance and increased exposure time due to longer working cycles.
Regarding handheld machines, small and light weight is desirable to reduce user fatigue. When sound insulation materials are added to reduce the noise machines become bigger and heavier. Process noise often dominates in practice, reducing the effectiveness of noise limits.

PNEUROP

PNEUROP, the European Association of Manufacturers of Compressors, Vacuum Pumps, Pneumatic Tools and Air & Condensate Treatment Equipment, provided two documents [68,69] in response to the ODELIA draft reports. PNEUROP agrees to only include concrete picks above 3 kg in the noise limits but has concerns if the EN 60745-2-6 standard is to be applicable (see comments in chapter 8). PNEUROP has reservations on the proposed limit changes for concrete breakers due to the dominance of process noise and has conducted tests to investigate this. It is expected that the limited noise reduction will result in too much performance loss. PNEUROP also questions the economic impact of reducing the compressor noise limit.

EUnited Municipal Equipment

EUnited Municipal Equipment, the European Association for Municipal Equipment provided background information and a summary paper [70,72] on aspects of noise limits for road sweepers (No. 46), refuse collection vehicles (No 47) and self-propelled snow removing machines with rotating tools (No. 51).
For road sweepers, an overview of sweeper types was provided, and the preferred limits were indicated, including the preference to combine the traction engine power in the technical parameter.
For Refuse vehicles, the preference was expressed to leave them in Article 13 until an improved test code is available.
For self-propelled snow removing machines with rotating tools, the preference is to take large machines according to EN 15906 out of the scope of the directive.

EUnited Cleaning

EUnited Cleaning, the European Association for Cleaning Machines, provided background information and a summary paper [71,73] on aspects of noise limits for high pressure cleaning equipment, sweepers and refuse vehicles. For high pressure cleaning equipment, advances have been made in reducing operating time by an operator presence switch, and tonality has been reduced.
Proposals for the input parameters for environmental impact were provided and have been adopted in this study. However no definitive information could be provided on the machine population.

ISMA

The International Snowmobile Association ISMA provided a letter [74] with background information on noise control on snowmobiles [75] and the need to apply the most recent SAE standard SAE J 192, Jan. 2013: SAE Surface Vehicle Recommended Practice on Maximum Exterior Sound Level for Snowmobiles, and

to take uncertainties into account when setting noise limits. ISMA recommends a sound pressure noise limit of L_{pAS} = 78 dB(A) at 15.2 m distance measured according to the SAE standard. In a follow-up letter New snowmobiles produced by ISMA member manufacturers are tested according to the test procedures
- SAE J-192 wide open throttle
- SAE J-1161 at constant velocity.

ISMA recommends the SAE J-192 sound pressure pass-by test which is required by law in the USA, Canada and Finland, and is voluntarily used for snowmobiles in Europe. ISMA is prepared to consider alternative methods more representative of average usage.

ISMA emphasises that the root cause of noise disturbance is due to machine modification by the users. A static test, SAE J-2641 and SAE J-2567 is available to enforcement officers to fine riders and remove modified machines. This is recommended by ISMA.

CEN

CEN was approached for an update of the current situation on test codes resulting in the latest information on new or modified standards. This is covered in chapter 8. From discussions with CEN it was clear that increased effort will be required to update or align all the standards with the directive, also resolving horizontal issues such as how to deal with process noise, work cycles, operating conditions and uncertainty.

Notified bodies

Several contributions were produced by the notified bodies [79-90] and others on various issues in relation to the Directive revision. These included TÜV Austria, CTER (Bulgaria), MTT (Finland), TÜV SÜD (Germany), ECO – ICE - I.C.E.P.I. - IMAMOTER (Italy) and INTERTEK (UK).

Issues put forward included:

- the revision of the text in line with the wording of the new Machinery Directive;
- the calculation of the guaranteed sound power level;
- the database of Article 16;
- the definitions of equipment to reflect modifications since 2000;
- the indication of any relevant noise related value in the Declaration of Conformity;
- the indication of possible mechanical power limitations in the Declaration of Conformity;
- update of the lists in Article 12 and Article 13 according to the NOMEVAL Report and WG7 position paper.

The great majority of comments, however, were related to the test codes reported in Annex III of the Directive. The received suggestions are summarised in table 5 below.

Table 5: Comments from Notified Bodies on test codes in Annex II of the Directive.

ANNEX III of Directive 2000/14/EC			
Item	**Topic**	**Suggestion**	**Proposer**
Part A 2.1 fan speed	Fan speed	add: (d) reversible fans	TÜV SÜD
Part A Environmental correction K_{2A}	"Equipment shall be measured on a reflecting surface of concrete or non-porous asphalt, then the environmental correction K_{2A} is set to K_{2A} = 0	Add the sentence: "unless a qualification procedure for the acoustic environment is performed (EN ISO 3744:201x, Annex A).	TÜV SÜD, IMAMOTER
Part B 0. Equipment tested free of load	Operating conditions during test	Period of observation at least 15 seconds or 3 operation cycles of the machine.	TÜV SÜD
Chain saw (6)	Test code ISO 9207	Change with test code in ISO 22868 (2005-02). Document available showing the correlation between the two test codes and the advantages of ISO 22868 in terms of reproducibility standard deviation.	IMAMOTER
Vibratory plates (8)	Poor repeatability of the test code indicated in the Directive	The noise level depends mainly on how the operator moves the machine or holds the handle. Suggestion: to use a stationary test	ICE
Lawnmower (32)	The shape of the blade has a great influence on the measured values	Definition and use of a standardized blade during noise measurements.	ECO
Lift trucks (36)	Noise measurements in drive condition at full acceleration.	This operating condition is dangerous and doesn't represent the typical operating condition for this type of equipment. Suggestion: test this machine at a defined speed, as for dumpers.	ICE
Mobile cranes (38)	1) Hoisting 2)The case of mobile cranes with non-slewing how to measure the slewing contribution (b)	1) Add these words to let the test be performed in safety way: "The mobile crane shall be loaded with a load which creates 50 % of the maximum" allowable "rope force" with safety factors provided by the manufacturer. 2) The slewing contribution (b) should be considered only if applicable. Two more formulas for the resulting sound power level should be included in order to include all the possible cases.	ICE I.C.E.P.I.
Truck mixer (55)	Operating conditions during noise measurements	For the noise test the drum is filled with concrete and operates at the maximum speed. Suggestion: to avoid using this kind of material as it cannot be completely removed after test.	ICE
Water pump unit (56)	Measurement surface	Use a hemispherical surface instead of a parallelepiped one.	ECO

4 Current trends in environment, technology, and market

Current general trends for outdoor equipment over the last decade in relation to environment, technology and market are discussed in this chapter, as far as these are considered relevant for this study.

4.1 Environment

Over the past decade, both the amount of noise disturbance and the sensitivity to it has increased. This is due to several factors:
- growth of all types of traffic
- population increase especially in urban areas
- numbers of vehicles and machines, in combination with further automation
- new infrastructure projects and urban (re)development
- growth in recreational activity such as events
- wider availability of low cost equipment, for example as found in supermarkets and via the internet
- stronger public awareness and reaction
- a shift in working patterns with more people able to work from home.

Also further research has been done on health effects of noise providing further understanding and the nature and magnitude of its impact on public health.
Much of this information is summarised in recent and ongoing studies published by the World Health Organisation WHO [45].

At the same time legislation has been amended both at national and EU level to address this, and both demand for quieter products and available information on noise emission has increased, especially on internet.

The nature of the noise from outdoor equipment remains specific and different to other sources such as road vehicles:
- equipment is often mobile;
- usage is temporary or periodical;
- when in use the noise source is more or less stationary or moving around a limited area;
- noise can occur at a wide variety of locations besides roads, such as in gardens, along pathways and parks, courtyards, close to dwellings, offices and sensitive locations such as hospitals, hotels, residential homes and schools, both in urban areas and in the countryside;
- high noise levels can occur, sufficient to cause severe annoyance or even sleep disturbance, even if not necessarily of long duration.

In the last decade more actions have been taken to protect the public against noise from construction work and other activities including noise mapping for large construction sites and noise monitoring. In some cases this is included in legislation limiting the duration of noise exposure at certain noise levels. This means that quieter equipment benefits all parties concerned, the contractors for being able to work longer and the public for undergoing less noise exposure.

With the increase in population density in urban areas, neighbour and community noise are more critical to quality of living. Noise disturbance can affect sleep, relaxation and concentration. Consequently, over the past decade, the demand for quieter products and available noise information which can be found on product datasheets and on the internet has increased.
Also local authorities and local services for street cleaning and park maintenance are aware of the noise issue and many take noise performance into account in the procurement process.

4.2 Technology

Over the past decade, several developments have affected noise emission and the potential noise reduction of outdoor equipment.

Hybrid drives are used increasingly in outdoor equipment, especially larger units. It is still not mainstream and the actual portion of hybrid equipment put on the market is unknown. The main benefits are fuel efficiency, lower exhaust emissions and noise reduction. The numbers of these can be expected to increase further depending on market conditions.

Electrically powered equipment is increasingly available mainly due to the improving performance and lower price of battery-powered units. As this develops further, numbers on the market can be expected to grow too, potentially replacing some of the ICE powered equipment. This is particularly relevant for consumer products and handheld equipment, where batteries can be separately carried in a backpack.

Combustion engine powered equipment is still in the majority for professional and large equipment types. Most of these have 4-stroke engines except for handheld units such as chainsaws, brush cutters and leafblowers with the noisier 2 stroke engines where weight is critical.

The conflict between noise and cooling requirements for combustion engines remains an issue, although quieter fans and improved airflow design are available; also electronic control for efficiency and noise reduction has advanced.

Electronic systems are available to control the peak impact force for mechanical processes or the time rate of pressure gradients for fluid dynamic processes, with positive effects in terms of noise reduction.

For many types of equipment, more quiet versions are available as demand and noise awareness has increased. The technical solutions are often available even if in some cases there may be a trade-off with performance or slightly higher cost.

Some new working principles have been developed resulting in significant noise reductions, for example:

Roller shredders: instead of a fast rotating blade impacting and cutting the material at high speed, it is cut with high force by slowly rotating rollers. Although these do not cut as finely as blade shredders, they can replace some of them and with considerable noise reduction.

For lawn mowers, robot mowers are slowly increasing in numbers and dropping in price, resulting in lower noise levels due to relatively slow operation.

Noise control affects many other important design features, such as speed, power, efficiency, weight and others. The usual approach to apply noise control solutions at the production stage, introduces significant constraints in the choice of possible noise solutions and available technologies, at the expense of the whole machine performance. These effects could be greatly limited if noise control were to be better included at the design stage of a machine together with all the other design parameters. This would also help reduce costs.

When noise is in conflict with performance, it is best to quantify this so as to achieve the best balance between the two factors.

For some equipment types with high process noise (such as for hydraulic hammers), the analysis of databases have shown great differences in the sound power levels for quite limited differences in the engine powers. This suggests that the fulfilment of stricter limits is possible even when the contribution of process noise is high.

4.3 Conflicting requirements

Many manufactures are confronted with requirements that are in conflict with noise reduction, such as reducing weight, increasing power and speed, process performance, and in particular reducing exhaust emissions of CE-powered machines. The industry associations state that the new emissions requirements lead to higher heat rejection and thereby increased cooling requirements. This would in theory lead to larger or faster fans potentially increasing noise levels. In addition it is stated that for diesel engines, in the last ten years the indirect injection system has been replaced by the direct injection fuelling system, causing higher noise levels.
Evidence on the conflict with noise reduction is however not yet well available.

4.4 Market

The market for outdoor equipment has developed over the past decade in the following general terms:

- Better availability of product information on the internet;
- more environmental awareness both of consumers and professional users including green procurement;
- More demand for quiet equipment;
- Growth in new variants of equipment;
- Growth in low cost consumer equipment.

4.5 Product segmentation and grouping

Due to technical progress a clear segmentation into product groups is not always clear cut. Examples of this are:

- construction equipment vehicles also used for cleaning purposes or recycling;
- Loaders both used for earth moving or goods lifting;
- compaction equipment used for waste compaction;
- leaf blowers used both for leaves and for street cleaning of dust, sand or refuse.

5 Limits of Article 12 equipment

In this chapter the current limits of equipment in Article 12 are assessed as to whether and how these should be revised in a future Regulation in the light of the latest evidence in relation to technical progress and performance characteristics.

In the analysis which evaluates the criteria described in section 2.2, a selection has been made of Article 12 equipment for which limits could be revised.

A general justification for noise limits
Noise limits for both means of transport and for machinery are intended to ensure that excessive and unnecessary noise is avoided, within reasonable technical and economic means. Limits ensure that noise is taken into account in the design process, and are a highly cost effective way of avoiding more expensive and often inadequate abatement measures at local level. In fact they benefit both users and exposed inhabitants, workers, people resting, at recreation and in quiet areas.

Noise limits represent the milestones of the EU noise policy to guarantee a common and uniform approach across Europe to reduce noise pollution in the environment. The existence of local permits and national regulations is insufficient reason not to apply EU noise emission limits as they are two complementary ways to reduce noise levels at the receiver but at two different levels.

For privately used equipment such as gardening tools, neighbourhood noise is a key issue, often not easy to regulate or enforce. In this case, noise emission limits will benefit a large number of people.

All means of transport have EU noise emission limits in addition to national regulations for traffic noise calculation and limitation. These are regularly reviewed and tightened where necessary. For example, the new EU regulation for noise emission limits for road vehicles [xx] has been published in 2014, tightening limits for all vehicle types including lorries and heavy road vehicles. These are also relevant for some of the OND equipment types powered by the vehicle engine, even if the operating conditions differ.

Customer demand for quieter products is not a sufficient indicator for the environmental need, as the customer is not always aware of the environmental noise impact.

The environmental need is based both on the newly evaluated environmental impact using the same methodology used in the Nomeval study, thereby allowing comparison with the current results. Stakeholder information from member states and internet data is also taken into consideration where available.

Information received from environmental stakeholders (associations of municipalities and noise abatement societies) mentioning Article 12 equipment includes lawnmowers and handheld CE powered garden tools, concrete breakers, excavators, generators and water pumps.

Some of the equipment types in Article 12 have a low environmental impact, in which case the limits are not required to change, but should be retained to avoid noisier models coming onto the market.

Where changes to the limits are proposed, this is mostly supported by evidence from the databases, using selected data where considered acceptable. Despite the limitations and critique of the database, it can provide an important resource in assessing limits as long as incorrect data are excluded. In addition, ad hoc checks have been carried out to compare the data with internet resources such as company websites.

Proposed limits take into account the pass rate for data in the databases, information from the industry stakeholders and technical and economic feasibility.

The timescale between 2007 and the expected coming into force of a revised regulation in 2021 is considered sufficiently long to contain several design cycles, which is why in some cases the second stage limits proposed in Nomeval are proposed, unless the databases or other information indicate otherwise. Given the availability of technical solutions and know-how the proposed limits are considered to be both technically and economically feasible. The expected long period until the introduction of the future limits make them also economically feasible even for those equipment types for which little progress in the low noise design has been made to date.

The new ODELIA limit proposals and previous ones from Nomeval, WG7 and stakeholders are set out in the sections below, together with justification and criteria for each new proposal. The new limit proposals are evaluated with the databases where feasible and are shown in Appendix C. A comprehensive overview of the proposed limits for all equipment types including unchanged ones is given in Chapter 9.

3. Builders' hoists for the transport of goods

	P ≤ 15 kW	P > 15 kW
Current (stage II)	93	80 + 11 lg P
Nomeval	93	80 + 11 lg P
WG7	93	80 + 11 lg P
CECE	93	80 + 11 lg P
FEM	Remove due to low numbers	
ODELIA	93	80 + 11 lg P
Decision code	**NEL1**	

Criteria and justification

Environmental need: CE-powered units are probably reducing in numbers. Limits should be retained to avoid noisy models reappearing.
Environmental impact: EI=42, low.
Technical feasibility: Quiet engines available.
Economic impact: None as limits stay the same.
Other remarks: Low numbers in database.

8. Compaction machines

8a1	WB Vibrating Roller		P ≤ 8	8 < P ≤ 70	P > 70	
	Current		108	109	89 + 11 lg P	(stage I)
	Nomeval		107	108	85 + 11 lg P	(stage II)
	WG7		105	106	86 + 11 lg P	(stage II)
	CECE		105	106	86 + 11 lg P	(stage II)
	ODELIA		105	106	86 + 11 lg P	(stage II)
	Decision	**NEMTF2**				
8a2	Other Vibrating Roller		P ≤ 8	8 < P ≤ 70	P > 70	
	Current		105	106	86 + 11 lg P	(stage I)
	Nomeval		105	106	86 + 11 lg P	(stage II)
	WG7		105	106	86 + 11 lg P	(stage II)
	CECE		105	106	86 + 11 lg P	(stage II)
	ODELIA		105	106	86 + 11 lg P	(stage II)
	Decision	**NEMTR1**				
8b1	Non-vibrating Roller, towed				No noise source	
	Decision	**NEL0**				
8b2	Non-vibrating Roller			P ≤ 55	P > 55	(stage II)
	Current			101	82 + 11 lg P	(stage II)
	Nomeval			101	82 + 11 lg P	(stage II)
	WG7			101	82 + 11 lg P	(stage II)
	CECE			101	82 + 11 lg P	(stage II)
	ODELIA			101	82 + 11 lg P	(stage II)
	Decision	**NEMTR1**				
8c	Vibratory Rammer		P ≤ 8	8 < P ≤ 70	P > 70	
	Current		108	109	89 + 11 lg P	(stage I)
	Nomeval		105	106	86 + 11 lg P	(stage II)
	WG7		105	105	Obsolete	(stage II)
	CECE		108	109	Obsolete	(stage I)
	ODELIA		107	108	Obsolete	
	Decision	**NEMTF2**				
8d	Vibratory Plates	P ≤ 3	3 < P ≤ 8	8 < P ≤ 70	P > 70	
	Current	105	108	109	89 + 11 lg P	(stage II/I)
	Nomeval	105	107	108	88 + 11 lg P	(stage I-1)
	WG7	105	107	108	88 + 11 lg P	(stage I-1)
	CECE	105	108	109	Obsolete	(stage I)
	ODELIA	105	107	108	88 + 11 lg P	(stage I-1)
	Decision	**NEMTR1/NEMTF2**				
8e	Explosion rammer (Art 13)				Obsolete	
	Decision	**NEL0**				

Criteria and justification

Environmental need: Compaction machines are a known source of annoyance generating directly and indirectly radiated noise in the environment. Larger numbers of small machines for consumer and rental market.

Environmental impact: EI=54, medium, probably higher when including indirect noise in practice, as operators often need hearing protection.

Technical feasibility: Difficult to achieve further reduction due to process noise, plate radiation for plates in particular.

Economic impact: Moderate effort to achieve 1 dB reduction for some subgroups.

Other remarks: CECE and D(UBA) proposed to put compaction equipment into 4 groups: Vibrating rollers, Non-vibrating rollers, Rammers and Vibrating plates harmonising the test cycles within each new category as also proposed by the NB.
CECE agrees to change in limit values for WB Vibratory rollers only if the test code will be changed from a gravel track to a static test such as that for ride-on vibratory rollers.
Type identification in the databases is difficult due to the variety of subtypes.

9. Compressors

	P ≤ 15 kW	P > 15 kW
Current	97	95 + 2 lg P
Nomeval	As current	
WG7	As current	
Pneurop	As current	
ODELIA	P ≤ 3 kW	P > 3 kW
	96	95 + 2 lg P
Decision code	**NEMTF2**	

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Current limits are already sufficient.

Environmental impact: EI=50 (medium).

Technical feasibility: Most data is on the limit, but below 3 kW there is room for limit reduction.

Economic impact: None

Other remarks: Pneurop expects economic impact to be larger.

10a. Concrete-breakers and picks, hand-held, CE-powered

	m<3kg	3 kg ≤ m ≤ 15 kW	15kg<m≤30kg	m>30kg
Current (stage II)	105		94 + 11 lg m	94 + 11 lg m
Nomeval	Exclude all m≤3kg	105	92 + 11 lg m	94 + 11 lg m
WG7	105		94 + 11 lg m	94 + 11 lg m
ODELIA	Exclude all m<3kg	105	92 + 11 lg m	94 + 9.6 lg m
Decision code	**NETR1**		**NETF2**	**NETF2**

10b. Concrete-breakers and picks, hand-held: Non-CE powered

	m<3kg	3 kg ≤ m < 15 kW	15kg≤m<30kg	m≥30kg
Current (stage II)	105		92 + 11 lg m	94 + 11 lg m
Nomeval	Exclude all m≤3kg	105	92 + 11 lg m	94 + 11 lg m
WG7	105		92 + 11 lg m	94 + 11 lg m
EPTA	Exclude Electrical m<3kg			
ODELIA	Exclude all m<3kg	105	92 + 11 lg m	94+9.6 lg m
Decision code	**NEL0**	**NETR1**	**NETF2**	**NETF2**

Criteria and justification

Environmental need: Hand-held concrete-breakers and picks are a known source of annoyance, producing impact noise. Larger numbers of small machines for consumer and rental market, some of which are also used indoors.

Environmental impact: EI=66, high. Operators need hearing protection.

Technical feasibility: Difficult to achieve further reduction due to process noise, which can vary strongly in practice. See Pneurop paper [68] and HSE report (UK) [85] . Many declared values on the limit. Proposed limits still have a high pass rate. Chisel damping is important.

Economic impact: Achievable small reduction according to database, therefore limited economic impact.

Other remarks: Exclude types with m<3 kg as mostly for indoor use. These have much lower environmental impact. Pneurop questions use of the EN 60745-2-6 test code due to the choice of loading device [68].

12. Construction winches a: CE powered b: Electric

	P ≤ 15 kW	P > 15 kW
Current (stage II)	93	80 + 11 lg P
Nomeval	Remove	
WG7	Move to Art 13	
FEM	Remove	
ODELIA	CE powered: stage II Electric: Art 13	
Decision code	**NEL1**	

Criteria and justification

Environmental need: Limited numbers but still present on market.
Prevent loud models reappearing.
Environmental impact: EI=34-35, low.
Technical feasibility: -
Economic impact: -
Other remarks: Low numbers in database.
FEM proposes to remove this equipment from the directive.
.

16. Dozers (< 500 kW) (a. wheeled, b. rubber tracked, c. steel tracked)

		P ≤ 55 kW	P > 55 kW	
Current	a	101	82 + 11 lg P	Stage II
	b	103	84 + 11 lg P	Stage II
	c	106	87 + 11 lg P	Stage I
Nomeval		a. Stage II b.Stage II c. Stage I		
WG7		a. Stage II b.Stage II c. Stage I		
CECE		a. Stage II b.Stage II c. Stage I		
ODELIA		a. Stage II b.Stage II c. Stage I		
Decision code		**NEMTR1**		

Criteria and justification

Environmental need: Keep noise levels within current limits.
Environmental impact: EI=52, medium.
Technical feasibility: Most declared levels on limit curves, probably little scope or incentive for reduction.
Economic impact: None.
Other remarks: Steel track noise unresolved.

18. Dumpers (< 500 kW)

	P ≤ 55 kW	P > 55 kW
Current	101	82 + 11 lg P
Nomeval	As current	
WG7	As current	
CECE	As current	
ODELIA	As current	
Decision code	**NEMTR1**	

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Current limits are already sufficient.
Environmental impact: EI=54 (medium).
Technical feasibility: 100% pass rate for available data but most is on the limit.
Economic impact: None
Other remarks: -

20. Excavators, hydraulic / rope (< 500 kW)

	P ≤ 15 kW	P > 15 kW
Current	93	80 + 11 lg P
Nomeval	As current	
WG7	As current	
CECE	As current	
ODELIA	As current	
Decision code	**NEMTR1**	

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Excavators are quite numerous but current limits are already sufficient.
Environmental impact: EI=57 (medium).
Technical feasibility: 100% pass rate for available data. 1 dB reduction in limit leads to 50% pass rate.
Economic impact: None
Other remarks: -

21. Excavator-loaders (< 500 kW) a. Wheeled b. Tracked

Rename to: Backhoe loaders.

	P ≤ 55 kW	P > 55 kW
Current Wheeled Tracked	 101 103	 82 + 11 lg P 84 + 11 lg P
Nomeval	As current	
WG7	As current	
CECE	As current	
ODELIA	As current	
Decision code	**NEMTR1**	

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Excavators are quite numerous but current limits are already sufficient.
Environmental impact: EI=55 (medium).
Technical feasibility: 100% pass rate for available data. 1 dB reduction in limit leads to too small pass rate.
Economic impact: None
Other remarks: -

23. Graders (< 500 kW)

	P ≤ 55 kW	P > 55 kW
Current	101	82 + 11 lg P
Nomeval	As current	
WG7	As current	
CECE	As current	
ODELIA	As current	
Decision code	**NEL1**	

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Graders are mainly used for new road construction or reconstruction of existing roads.
Environmental impact: EI=45, low.
Technical feasibility: 100% pass rate for available data.
Economic impact: None
Other remarks: Only 9 records in all databases.

29. Hydraulic power packs

	P ≤ 40 kW	40 kW< P ≤ 55 kW	P > 55 kW
Current	101	101	82 + 11 lg P
Nomeval	99	82 + 11 lg P	82 + 11 lg P
WG7	101	101	82 + 11 lg P
CECE	101	101	82 + 11 lg P
ODELIA	101	101	82 + 11 lg P
Decision code	**NEL1**		

Criteria and justification

Environmental need: Keep noise levels within current limits.
Environmental impact: EI=41, low.
Technical feasibility: Most declared levels on limit curves, probably little scope or incentive for reduction.
Economic impact: None
Other remarks: -

31. Landfill compactors, loader+bucket (<500 kW)

	P ≤ 55 kW	P > 55 kW
Current	101	82 + 11 lg P
Nomeval	Remove	
WG7	As current	
CECE	As current	
ODELIA	As current	
Decision code	**NEL1**	

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Only used in landfill areas.
Environmental impact: EI=27 (very low) due to low numbers and distance from dwellings.
Technical feasibility: Available data is on the limit.
Economic impact: None
Other remarks: Only 2 records in all databases.

32. Lawnmowers (excluding agricultural and forestry equipment, …)

	L≤50cm	50<L≤70cm	70<L≤120cm	L>120cm
Current	96	98	100	105
Nomeval	71+15 lg L			73+15 lg L
WG7	96	98	100	105
EGMF	96	98	100	105
ODELIA	**77+12 lg L**			**73+15 lg L**
Decision code	**NETF2**			

Criteria and justification

Environmental need: Most lawnmowers are used for home gardening, often causing neighbourhood annoyance, being one of the most numerous type of garden equipment.
Limit revision should therefore be considered, preferably eliminating large steps between ranges.

Environmental impact: EI=69 (very high), especially due to the high number of machines in use in residential areas and on the market, and the often strong tonality of the noise, which justifies the changing the limit values. Two different figures for usage time were used for consumer and professional lawnmowers.

Technical feasibility: Technical solutions to reduce machine noise and recent R&D studies on blade noise are available. Electric mowers are widespread and some machines are marked as ‘low noise machine’. EGMF insists that further reduction is not feasible due to flow noise and constraints on cutting performance. If the flow noise is dominant then the current fixed step approach is not consistent and should be improved.

Economic impact: Only a relatively small part of the equipment is affected by these new limits but the overall benefits could be very high due to the large number of people affected.

Other remarks: The limit should be a function of the technical parameter. Otherwise a slight variation in the technical parameter around the boundary value induces a large variation in the permitted limit value.

33. Lawn trimmers/lawn edge trimmers

	L<30cm	30 cm≤L≤50 cm	50<L≤70cm	70<L≤120cm	L>120cm
Current	96		98	100	105
Nomeval	91				
WG7	95	96			
EGMF	96				
ODELIA	**95**				
Decision code	**NEMTF2**				

Criteria and justification

Environmental need: Most of these machines are used for home gardening regularly causing annoyance for the neighbourhood. Limits should be kept and revised.

Environmental impact: EI=56 (medium). Compared to the Nomeval estimate, the population of these machines 3.5 times larger. They used a few times a year, but the large numbers, acoustic characteristics of intermittent operation and impulsivity justify the reduction of the limit value.

Technical feasibility: Low noise cutting lines exist, but further reduction of process noise is difficult.

Economic impact: Only a small part of the equipment is impacted.

Other remarks: The proposed limit is only for L≤50 cm. No data for machines above 50 cm.

36. Lift trucks, combustion-engine driven, counterbalanced (excluding 'other counterbalanced…)

Definition: Include Reach stackers and Straddle carriers.

	P ≤ 55 kW	P > 55 kW	
Current	104	85 + 11 lg P	(Stage I)
Nomeval	101	82 + 11 lg P	(Stage II)
WG7	101	82 + 11 lg P	(Stage II)
FEM	104	85 + 11 lg P	(Stage I)
ODELIA	102	83 + 11 lg P	(Stage II+1)
Decision code	**NETF2**		

Criteria and justification

Environmental need: Lift trucks are used in a variety of environments, for goods handling, around construction sites, delivery and logistics sites and in industrial areas, sometimes near dwellings.

Environmental impact: EI=60 (high) due to large numbers of these machines and high duration of use.

Technical feasibility: A modest limit reduction of 2 dB should be technically possible. FEM indicates better information and specification at component level is required.

Especially fan noise and engine noise need reducing. Numbers of hybrids are increasing. Electrically powered machines are also for use indoors.

Economic impact: Some design effort will be required and engine and fan specifications set to suppliers. Medium impact, but given the timescale it is considered manageable.

Other remarks: Larger CE-powered units should be included such as reach stackers and straddle carriers.
FEM states: It is very challenging to fulfil the existing limits and it will be even more difficult with the future generation of engines. Consequently there is no room for any reduction of the noise emission. Also there is little customer demand.

37. Loaders

	P ≤ 55kW	P > 55kW
Current Wheeled Rubber tracked Steel tracked	 101 (Stage II) 103 (Stage II) 103 (Stage II)	 82 + 11 lg P (Stage II) 84 + 11 lg P (Stage II) 87 + 11 lg P (Stage I)
Nomeval	As current	
WG7	As current	
CECE	As current	
ODELIA	As current	
Decision code	**NETR1**	

Criteria and justification

Environmental need: Loaders are used in a variety of environments, for construction, goods handling and clearing, frequently in urban areas and near dwellings.

Environmental impact: EI=60 (high) due to large numbers and high duration of use.

Technical feasibility: Databases indicate that further reduction may be difficult as the majority are on the limit.

Economic impact: None as no change in limits proposed.

Other remarks: Percentage of quieter hybrids may increase (no data available).

38. Mobile cranes

	P ≤ 55 kW	P > 55 kW
Current (stage II)	Stage II: 101	Stage II: 82 + 11 lg P
Nomeval	Stage II	
WG7	Stage II	
FEM	Stage II	
ODELIA	100	81.5 + 11 lg P
Decision code	**NEMTF2**	

Criteria and justification

Environmental need: Mobile cranes often operate near dwellings and multi-storey buildings in urban areas.

Environmental impact: EI=49 (medium), which justifies the changing the limit values.

Technical feasibility: Technical solutions for noise reduction are available. The databases show an acceptable pass rate of 65% for a 1 dB reduction in the limit values.

Economic impact: Estimated to be limited due to available technology and solutions.

Other remarks: FEM indicates that about one third of the cranes currently cannot fulfil the lower limit value. This is in line with the database pass rates. FEM suggests not to include vehicle mounted loader cranes (no. 108) due to the different test cycle and dependence on vehicle engine noise.

40. Motor hoes (< 3 kW)

	P < 3 kW
Current	93
Nomeval	Remove
WG7	As current
CECE	As current
ODELIA	As current
Decision code	**NEL1**

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Mainly used in rural areas.

Environmental impact: EI = 24 (very low) due to low noise level and rural environment.

Technical feasibility: Available data is on the limit.

Economic impact: None

Other remarks: -

41. Paver-finishers (b1. without or b2. with compacting screed)

	P ≤ 55 kW	P > 55 kW
Current	b1. Stage II: 101 b2. Stage I: 104	b1. Stage II: 82 + 11 lg P b2. Stage I: 85 + 11 lg P
Nomeval	b1. Stage II b2. Stage I	
WG7	b1. Stage II b2. Stage I Check wording	
CECE/2015	Compacting screed: 104, 85 + 11 lg P Pre-compacting screed: 101, 82 + 11 lg P	
ODELIA	As current, if fleet numbers correct.	
Decision code	**NEL1**	

Criteria and justification

Environmental need: Paver-finishers may be potentially noisy, but their presence is generally low, only appearing when road surfaces are renewed.

Environmental impact: EI=42 (low), therefore no limit change.

Technical feasibility: -

Economic impact: None

Other remarks: -

45. Power generators (a. < 400 kW b. ≥ 400 kW)

	$P_{el} \leq 2$	$2 < P_{el} \leq 10$	$10 < P_{el} < 400$	$P_{el} \geq 400$
Current	95 + lg P_{el}	96 + lg P_{el}	95 + lg P_{el}	Art 13
Nomeval	90	93	93 + 2 lg P_{el}	93 + 2 lg P_{el}
WG7	93 + lg P_{el} 90	96 + lg P_{el} 94 + lg P_{el}	95 + lg P_{el} 93 + 2 lg P_{el}	75 + 11 lg Pel 93 + 2 lg Pel
ODELIA	94 + lg P_{el}	95 + lg P_{el}	94 + lg Pel	75 + 11 lg Pel
Decision code	**NETF2**			**NETMTF4**

Criteria and justification

Environmental need: Smaller generators are produced in large numbers and are used for home standby, outdoor power supplies and recreational purposes such as boating, caravanning and others. Running times may be significant causing potential complaints especially when near dwellings. Medium and larger size generators are used in construction, backup and temporary energy supply for example for events. Some of the larger units are containerised or permanently placed. Some are for indoor placement, being potentially out of the scope of the directive. Many low noise versions are available.

Environmental impact: With a high environmental impact EI=60 due to high machine population numbers and relatively long operating times in a variety of environments, tighter limit values are justified. Generators are known to be a potential source of complaints in certain situations.

Technical feasibility: Technically, most generators can be designed to have very low noise levels, so cost and demand often determine the specifications. Europgen considers the WG7 proposals both realistic and technically achievable given the existing product technology level in the current market. The proposed limits show pass rates around 55-71% for the combined databases.

Economic impact: Europgen states that product costs are likely to increase, but not in a restrictive manner. Overall benefits could be high due to the large number of people affected.

Other remarks: See Europgen papers *[63, 64].*

53. Tower cranes

Current	96 + lg P
Nomeval	As current
WG7	As current
CECE	As current
ODELIA	As current
Decision code	**NEL1**

Criteria and justification

Environmental need: Keep noise levels within current stage II limits. Mainly used in rural areas.

Environmental impact: EI=33 (very low) due to low average noise levels and low numbers.

Technical feasibility: Further reduction is possible but not necessary.

Economic impact: None

Other remarks: Only 2 records in all databases.

57. Welding generators

	$P_{el} \leq 2$	$2 < P_{el} \leq 10$	10 <Pel
Current	95 + lg P_{el}	96 + lg P_{el}	95 + lg P_{el}
Nomeval	90	93	93 + 2 lg P_{el}
WG7	93 + lg P_{el} 90	96 + lg P_{el} 94 + lg P_{el}	95 + lg P_{el} 93 + 2 lg P_{el}
ODELIA	94 + lg P_{el}	95 + lg P_{el}	94 + lg Pel
Decision code	**NEMTF2**		

Criteria and justification

Environmental need: Welding generators are less numerous than other generators, with smaller ones for home use and all sizes for professional use. Generators can be a potential source of complaints near dwellings.

Environmental impact: EI=53 (medium).

Technical feasibility: Technically, most generators can be designed to have very low noise levels, so cost and demand often determine the specifications. The same limits are proposed as for generators.

Economic impact: Product costs are likely to increase, but not in a restrictive manner.

Other remarks: Less data in databases than for generators and smaller difference between guaranteed and measured levels.

6 Limits for Article 13 equipment

This chapter addresses the question whether it is appropriate for any, or all of the equipment in Article 13 to be assigned mandatory limit values in a future Regulation and, if so, what these should be.

European noise emission limits have to be considered the main policy instrument to guarantee a common and uniform approach to reduce the negative effects of noise exposure. Other instruments at national level such as local regulations and permits should be considered complementary supporting actions.

A selection has been made of Article 13 equipment which could be moved to Article 12. The criteria are evaluated as follows.

Besides the environmental impact indicator, which is a calculated ranking indicator, the environmental need for limits also depends on information and requests from member states. For this reason, the decision diagram for Article 13 equipment includes a decision box for 'Severe local noise problems in one Member State', which covers those cases where a significant amount of complaints and/or member state requests are made for specific types of equipment whose use and negative effects are predominant only in some member states. In such a case, this condition is considered a sufficient justification for noise limits even if the environmental impact indicator, calculated taking into account the number of noise exposed persons across Europe, turns out to be low. For example, the snowmobiles with a low estimated overall environmental impact are still a cause for many local complaints in certain areas. As the member states are not allowed to set their own noise emission limits, European limits are the only option beyond local regulations.

The technical feasibility of new limits is assessed from the databases, product data available on the internet, information from stakeholders, presence of quieter models on the market and known technical solutions and constraints.

Economic feasibility is also assessed, taking into account the estimated pass rate of the limits where possible and the technical effort required to meet the limits.

The lack of a suitable test code, large uncertainty factor, presence of process noise, local regulations or large size of machines should not be obstacles to proposing noise limits if the need is established. Test codes with shortcomings should be worked on to allow timely introduction of new limits.

Article 13 equipment specifically mentioned by environmental stakeholders includes private and professional gardening equipment, leaf blowers/collectors, brush cutters, chainsaws and other small CE powered equipment, glass recycling containers, chippers/shredders, piling equipment, hydraulic hammers, paver-finishers and water pumps.

Many of the equipment types in Article 13 have medium or higher environmental impact due to high noise levels, large numbers of equipment, sensitive operation times, operating locations, duration, distance to dwellings and/or affected population numbers.

Based on the environmental indicator levels, only a few equipment types are less relevant for noise limits due to estimated low environmental noise impact. These are:

3b. Electric builder's hoists
12b. Electric construction winches
8a. Explosion rammers, because they are obsolete
41a. Paver-finishers with a high-compaction screed
44. Piste caterpillars
43. Pipelayers
48. Road milling machines
51. Snow-removing machines with rotating tools
52. Suction vehicles
54. Trenchers.

Some of these have higher impact than in the past, although still low, due to increased numbers and/or usage in more sensitive areas. Piste Caterpillars for example, may be used at more locations and at night and evening hours, and snow removing machines may be used at early hours in town and village centres.

Equipment for loading and unloading silos or tanks on trucks (19) is still an unclear case requiring better data for environmental impact and current numbers in service. But it does fall under the category of delivery vehicles which can cause disturbance in urban areas.

Suction vehicles (52) are to be combined with high pressure flushers (29).

Aerial access platforms (1) are assessed to have medium environmental impact based on the sound power levels corrected for the work cycle, despite the decreasing numbers of CE powered units. Figures for annual engine running duration and working cycle from FEM support this conclusion.

Technical progress has been made on many Article 13 equipment types and often quieter versions are on the market. Examples are observed in electric or hybrid powertrains, improved work processes such as roller shredders, and application of already well established noise abatement technology such as damping, shielding, electronic engine control and energy management, quieter engines and cooling fans.

In terms of economic impact of introducing limits this is generally deemed to be small due to the wide availability of noise control solutions, components and know-how. In addition, the timescale from 2007 to the potential introduction of revised regulation in 2021 is such that even small companies can adopt existing technologies within their normal product development cycle.

Many SMEs may be affected as they are active in many of the equipment categories.

The databases show clearly that a wide spread of noise levels can be found for Article 13 equipment including many with lower noise levels. This can have different causes:

- large variety of subtypes
- large measurement uncertainty or shortcomings of test codes
- lack of incentive to reduce the noise.

Each equipment type which is considered eligible for noise limits is listed in the sections below, together with a proposal for the noise limits, comparison with previous proposals, justification and criteria evaluated.

The ODELIA proposals are mostly given as a single stage which if adopted would be come into force around 2021. Sometimes a second stage is suggested.

The limits proposed are based on acceptable pass rates of 50-80% and clear trends in declared data, where the databases allow. Technical and economic feasibility also are taken into account when proposing a limit.

Indicators for technical feasibility are the spread of declared values below the limit and the uncertainty factor K.

Where the databases have been used to support the recommendations, the data is presented in Appendix B. All the graphs show the guaranteed values.

A comprehensive overview of the proposed limits for all equipment types including unchanged ones is given in Chapter 9.

1. Aerial access platforms with combustion engine

	P≤25 [kW]	25<P≤55 [kW]	P>55 [kW]
Nomeval	101		82+11 lg P
WG7	104		85+11 lg P
FEM	104	108	89+11 lg P
ODELIA	P≤60 [kW]		P>60 [kW]
	104		**87+9.3 lg P**
Decision code	**NEMTF4**		

Criteria and justification

Environmental need: Aerial access platforms often operate close to multi-storey buildings including offices, flats, and sensitive residential buildings, just like mobile cranes.
CE-powered models are mostly for outdoor use.
Limits should exclude unnecessarily high noise levels.

Environmental impact: Estimated low in Nomeval at 46, but now medium with EI=52 justifying the proposal of a limit value. This is due to:
- a higher average guaranteed sound power level for CE powered machines of 102 dB(A) than used in Nomeval of 94 dB(A);
- (engine) operating time of around 600 instead of 200 hours/year based on FEM data;

- lower machine population, 91000 instead of 200000, based on FEM data.
For CE-powered equipment FEM suggests typical sound power levels of around 104-107 dB(A) for high idle engine speed for 30% of the time and around 90-95 dB(A) at low idle for 70% of the time. For the environmental impact this implied equivalent sound power levels of 99-102 dB(A), but a correction for the loaded condition still has to be taken into account (3 dB) and a penalty for intermittent operation (6 dB).

Technical feasibility: The proposed limit shows an 78 % overall pass rate for the databases. Space is often available for noise control including encapsulation and suitable mufflers. Power management is commonplace to save fuel. Electric or hybrid powertrains are becoming more common.

Economic impact: Considered small as technology is available.

Other remarks: CE-powered machines are being gradually replaced by electrical ones, currently estimated at 50% for boom lifts and 75% for scissor lifts. The databases show little relation with the installed power, but data may be missing.

2. Brush cutters and 24. Grass trimmers/grass edge trimmers

	P≤1.5 [kW]	P>1.5 [kW]
Nomeval	Stage I: 105+6P Stage II: 103+6P	
WG7	Stage I: 107+6.3P Stage II: 105+6.3P	Art.13
EGMF	107+6.3P	Art.13
ODELIA	**107+5.5P**	**115**
Decision code	**NETF4**	

Criteria and justification

Environmental need: A large number of these machines is used in gardens, streets and green spaces in residential areas. A small percentage, mainly the higher powered professional types, is used more, but not only, in rural areas such as woodland and for wayside maintenance along roads. Limits should exclude unnecessarily high noise levels, including rural areas. For this reason, also for the higher power range a limit is proposed.

Environmental impact: The dramatic increase of the population actually on the market, the very high noise emission levels and the prominent tonality of the noise itself cause a very high impact which justifies the proposal of a limit value. Also the 10% which is professional equipment is a substantial number justifying a limit.

Technical feasibility: Although weight and performance are an issue, the database shows that it is feasible to reduce the noise

levels of the noisiest models. The overall pass rate is 70%, 59% in the low power range and 90% in the high power range.

Economic impact: Small, as limit proposal is not very tight.

Other remarks: For P>1.5kW, the guaranteed levels in the EU and MARA databases show little dependence on power, even decreasing somewhat for increasing net power. Therefore a constant limit is considered appropriate for P>1.5 kW.

3b. Builders' hoists, goods (electric motor)

Nomeval	Remove
WG7	Art. 13
ODELIA	Art. 13
Decision code	**NEL3**

Criteria and justification

Environmental need: Electric builder's hoists are very common and are fairly quiet.

Environmental impact: EI= 38 (low).

Technical feasibility: -

Economic impact: None

Other remarks: Little data in database, but for electric equipment levels may be comparable to handheld professional garden equipment, 95-105 for electric models.

4. Building site band saw machine

Nomeval	Remove
WG7	Art. 13
ODELIA	Art. 13
Decision code	**NEM3**

Criteria and justification

Environmental need: Building site band saw machines are a common type of power tool.

Environmental impact: EI= 55 (medium).

Technical feasibility: -

Economic impact: None

Other remarks: -.

5. Building site circular saw bench

Nomeval	110
WG7	Art. 13
ODELIA	111
Decision code	**NEMTF4**

Criteria and justification

Environmental need: Sawing machines can produce high noise levels at building sites and residential areas and are quite common.

Environmental impact: EI= 55 (medium) which justifies the proposal of a limit value.

Technical feasibility: The sawblade is the main source, so the limit should encourage application of quieter sawblades which are on the market.

Economic impact: Small, as quieter sawblades are available.

Other remarks: Consistency with limits for other sawing machines should be observed, such as joint cutters and handheld cut-off saws.

6a. Chain saws: CE powered

	P≤2.5 [kW]	P>2.5 [kW]
Nomeval	Stage I: 110+2P Stage II: 108+2P	
WG7	Stage I: 112+2P Stage II: 111+2P	Stage I: 114+2P Stage II: 113+2P
EGMF	112+2P	Art.13
ODELIA	**111+2P (new test code)**	
Decision code	**NETF4**	

6b. Chain saws: Electric

Nomeval	104
WG7	Stage I: 102+4P Stage II: 100+4P
EGMF	102+4P
ODELIA	**100+4P**
Decision code	**NETF4**

Criteria and justification

Environmental need: A large number of these machines is used in residential areas. A smaller percentage, mostly professional types is also used in rural areas such as woodland and for wayside maintenance along roads.
Chainsaws are mentioned by Eurocities.
Limits should exclude unnecessarily high noise levels.

Environmental impact:	The large number of machines on the market and in use, the very high noise emission levels and the prominent tonality of the noise itself have a high impact which justifies the proposal of a limit value.
Technical feasibility:	Silenced models are available on the market. Although weight and performance are an issue, the database shows that it is feasible to reduce the noise levels of the noisiest models excluding only 11 %.
Economic impact:	Small, as limit proposal is not very tight.
Other remarks:	The data cloud of the measured value (L_{Wm}) either of both EU and MARA databases does not shift at 2.5 kW. The proposed limit value takes into account the effect of changing the test code. EGMF states that the second stage of WG7 is too difficult to achieve.

7. Combined high pressure flushers and suction vehicles
26.High pressure flushers
52. Suction vehicles

Nomeval	109	
WG7	109	
EUnited	No comments	
ODELIA	P ≤ 55 kW	P > 55 kW
	108	**89 + 11 lg P**
Decision code	**NEMTF4**	

Criteria and justification

Environmental need:	These machines can produce high noise levels and operate in urban and residential areas. Limits should exclude unnecessarily high noise levels.
Environmental impact:	EI=49/47/45 (medium) The high noise emission and medium environmental impact justifies the introduction of a limit value.
Technical feasibility:	Quieter engines, quieter hydraulics and especially electronic control may be implemented, all avaiable technology.
Economic impact:	Only a small part of the equipment is impacted.
Other remarks:	*Combine with 26 and 52 due to similarities. Nearly no machines in Databases for 26.and 52.*

8e. Compaction machines/Explosion rammers

There is general consensus that this equipment can be removed from the directive as it is obsolete.
Decision code: NEL0

11. Concrete or mortar mixers

Nomeval	Art. 13	
WG7	Art. 13	
ODELIA	P≤ 2 kW	P>2 kW
	95	92 + 11 lg P
Decision code	**NEMTF4**	

Criteria and justification

Environmental need: Significant number of types in database, many found in construction sites, and for rental, often used close to dwellings. Limits should exclude unnecessarily high noise levels.
Environmental impact: EI=48 (medium)
Technical feasibility: Quieter engines, transmissions and damped barrel.
Economic impact: Only a small part of the equipment is impacted.
Other remarks: -.

12b. Construction winches, electrically powered

Nomeval	Remove
WG7	Art. 13
FEM	Remove due to low numbers
ODELIA	Retain in Art. 13
Decision code	**NEL3**

Criteria and justification

Environmental need: Numbers increasingly replacing CE powered units.
Environmental impact: EI=35 (very low)
Technical feasibility: -
Economic impact: None
Other remarks: To avoid reappearance of noisy equipment, not obsolete.

13. Conveying and spraying machines for concrete and mortar

Nomeval	Art. 13
WG7	Art. 13
CECE/2015	Art. 13
ODELIA	93 + 11 lg P
Decision code	**NEMTF4**

Criteria and justification

Environmental need: Increased usage in construction in urban areas for multi-storey and other buildings. Both truck-mounted models, trailer models and manually controlled models. Limits should exclude unnecessarily high noise levels. Larger models can produce high noise levels.
Environmental impact: EI=47 (medium)

Technical feasibility: Quieter engines, transmissions, pumps and use of enclosures.
Economic impact: Only a small part of the equipment is impacted.
Other remarks: Significant number in database.
For models powered by the truck engine, the according power should be used as technical parameter.
Test code should refer to EN ISO 12001:2012 (Appendix C).

14. Conveyor belts

Nomeval	Remove
WG7	Art. 13
FEM	Refine classification
ODELIA	Retain in Art. 13 or combine with truck mixers
Decision code	**NETR3**

Criteria and justification

Environmental need: Insufficient information available.
Environmental impact: EI = 57 (high), due to high noise level, but large uncertainty due to lack of data.
Technical feasibility: Quieter engines and transmissions.
Economic impact: None as no limits proposed.
Other remarks: One model in databases. Nevertheless still relevant for construction and logistics. Some models integrated with truck mixers. For models powered by the vehicle engine, the according power should be used as technical parameter.

15. Cooling equipment on vehicles

Nomeval	Stage I: 96 + 2 lg P Stage II: 90 +2 lg P
WG7	Stage I: 96 + 2 lg P Stage II: 90 +2 lg P
ODELIA	CE-powered: 104 +2 lg P Other: 90 + 2 lg P
Decision code	**NETF4**

Criteria and justification

Environmental need: Frequent use at all hours and near dwellings and in urban areas.
Environmental impact: EI = 59 (high), due to large numbers, noise levels and duration.
Technical feasibility: Quiet models are on the market already.
Economic impact: Small as technology is available.
Other remarks: Further checks on limits versus model types required.

17. Drill rigs

	P≤ 55 kW	P> 55 kW
Nomeval	99	86 + 11 lg P
WG7	Stage I: 92 + 10 lg P Stage II: 99	Stage I: 92 + 10 lg P Stage II: 86 + 11 lg P
CECE	Art. 13 Proposes subtypes percussive and non-percussive	
ODELIA	P≤ 30 kW	P> 30 kW
a. Percussive	128	
b. Non-percussive	107	92 + 10 lg P
Decision code	**NEMTF4**	

Criteria and justification

Environmental need: Potentially high noise levels especially for percussive drill rigs which can operate in a variety of areas.

Environmental impact: EI = 50 (medium)

Technical feasibility: High noise limit for percussive machines, therefore considered feasible.

Economic impact: Moderate as about 20% will be affected.

Other remarks: Limits needed also because of high noise levels. Reference should be given to EN ISO 3744 according to EN16228-1 to 7.

19. Equipment for loading and unloading silos and tanks

Nomeval	Art. 13
WG7	Art. 13
ODELIA	Art. 13
Decision code	**NEM3**

Criteria and justification

Environmental need: Potential disturbance during loading/unloading near dwellings.

Environmental impact: EI= 47 (medium).

Technical feasibility: Insufficient data for evaluation, none in database.

Economic impact: None

Other remarks: WG7: Adopt the Compressors (9) test code. Testing the power pack (engine and compressor as installed) and not necessarily the whole trailer or truck.

22. Glass recycling containers

Nomeval	100
WG7	Stage I: 98 Stage II: 96
ODELIA	Stage I: 100 Stage II: 96
Decision code	**NETF4**

Criteria and justification

Environmental need: Numerous equipment present near most shopping centres. Many now placed underground and quieter than previous models. Noisy models should be excluded. Mentioned by Eurocities.

Environmental impact: EI = 62 (high) due to large numbers.

Technical feasibility: Underground or damped versions should easily fulfil the limits, therefore a tighter second stage is included.

Economic impact: Small as solutions are available and on the market.

Other remarks: -

24. Grass trimmers/grass edge trimmers

Nomeval	Combine with brush cutters (2)
WG7	See (2)
ODELIA	Combine with brush cutters (2)
Decision code	**NETF4**

See type 2.

25a. Hedge trimmers, CE powered

Nomeval	109
WG7	Stage I: 110 Stage II: 108
EGMF	Art.13
ODELIA	**108**
Decision code	**NETF4**

25b. Hedge trimmers: Electric

Nomeval	Art.13
WG7	Stage I: 100 Stage II: 99
EGMF	Art.13
ODELIA	**100**
Decision code	**NETF4**

Criteria and justification

Environmental need: These machines are numerous and used privately in and around residential gardens, and professionally for green maintenance in streets and parks. Potentially a

source of disturbance. Limits should exclude unnecessarily high noise levels.

Environmental impact: EI=65 (high)
Compared to the Nomeval estimate, the population of these machines is six times larger. They are used a few times a year, but the high noise levels of the CE powered models cause a high impact which justifies the proposal of a limit value.

Technical feasibility: Quieter engines exist. Electric models are widespread.

Economic impact: Among the CE powered models, only a small percentage of the equipment in the EU and MARA databases has a guaranteed level above the proposed limit.

Other remarks: A 1 dB margin has been taken into account for the change in the test code.
EGMF suggests that electric trimmers should be treated differently in the measurement as they have no idling.

26. High pressure flushers

Nomeval	109 Combine 7, 26 and 52 in one group
WG7	109
ODELIA	Combine 7, 26 and 52 in one group

See type 7.

27. High pressure water jet machines

	P ≤ 3kW	P > 3 kW
Nomeval	95	Art. 13
WG7	95	Art. 13
EGMF	Art. 13	Art. 13
EUnited Cleaning	Art. 13	Art. 13
ODELIA	Art. 13	Art. 13
Decision code	**NEL3**	**NEL3**

Criteria and justification

Environmental need: The number of these machines is high. Many are small machines for home and gardening use with intermittent noise. Recently, tonal noise has been reduced and operating time reduced (automatic switch off if not used).

Environmental impact: EI=45(low). The estimated number of machines is two times larger compared to Nomeval but the operating time is shorter and the tonality/impulsivity is reduced.

Technical feasibility: -

Economic impact: -

Other remarks: Database contains a mix of CE and electric equipment, with mixed technical parameter, flow rate or power. Most with higher sound power level are combustion engine powered for industrial use.
EUnited Cleaning suggests that due to small numbers of machines in the market for commercial and industrial applications, only single phase electric cold water unheated high pressure cleaners for non-commercial use need to be covered by regulation.

28. Hydraulic hammers

Nomeval	Stage I: 93 + 10 lg m Stage II: 90 + 10 lg m
WG7	Stage I: 120 + 3 lg m Stage II: 117 + 3 lg m
CECE	Stage I: 116 +10 lg P Stage II: 113 +10 lg P
CECE/2015	New up to date data collection required
ODELIA	Stage I: 120 + 3 lg m Stage II: 117 + 3 lg m
Decision code	**NETF4**

Criteria and justification

Environmental need: Hydraulic hammers produce high levels of impact noise, often in urban areas and near dwellings. Limits should exclude unnecessarily high noise levels. Mentioned by Eurocities.

Environmental impact: EI=78 (very high), due to high noise levels and large numbers working significant hours.

Technical feasibility: Isolated hammers are quieter an can fulfil the proposed limit. Other options for noise reduction such as hammer damping and shielding techniques need more evaluation.

Economic impact: About 20% of the equipment is affected.

Other remarks: The databases contain numerous models, some with an isolated hammer which reduces the noise.
Further evaluation is required of the CECE proposal to replace mass by installed power as technical parameter.

30. Joint cutters

Nomeval	111
WG7	Art. 13
ODELIA	111
Decision code	**NETF4**

Criteria and justification

Environmental need: Joint cutters can produce very high noise levels in urban and residential areas. Limits should ensure use of quieter sawblades.

Environmental impact: EI= 61 (high) which justifies the proposal of a limit value.
Technical feasibility: The sawblade is the main source, so the limit should encourage application of quieter sawblades which are on the market. Limit would allow 69% pass rate.
Economic impact: Small, as quieter sawblades are available.
Other remarks: Consistency with limits for other sawing machines should be observed, such as sawbenches and handheld cut-off saws.
EGMF states that joint cutters cannot be combined with handheld cut-off saws due to differing weight, support, performance and blade diameter.

34a. Leaf blowers and 35a. Leaf collectors, CE powered

	P≤ 1.5 kW	P> 1.5 kW
Nomeval	104	
WG7	Stage I: 108 Stage II: 106	Stage I: 111 Stage II: 109
EGMF	108	Art 13
ODELIA	106	109
Decision code	**NETF4**	

34b. Leaf blowers and 35b. Leaf collectors, electrically powered

Nomeval	99
WG7	107
EGMF	107
ODELIA	105
Decision code	**NETF4**

Criteria and justification
Environmental need: Leaf blowers and collectors are a frequently mentioned source of annoyance, both consumer models and professional models. Large numbers are in use. Besides autumn use they are also used for clearing dust, clippings and refuse at any time of year. Many complaints and websites about annoyance of leaf blowers.
Environmental impact: EI= 57/59 (high) which justifies the proposal of a limit value.
Technical feasibility: The fan and engine are main noise sources, both possible to reduce in level.
Economic impact: Small, as quieter models exist already and the market is large. Electric and battery models will gradually increase anyway.
Other remarks: Rename to: Blowers and collectors for cleaning and leaf clearing and handheld vacuum shredders.

36b. Lift trucks, CE (others excl. container handling)

	P≤ 55 kW	P> 55 kW
Nomeval	101	82 + 11 lg P
WG7	Art. 13	
FEM	Art. 13	
ODELIA	102	83 + 11 lg P
Decision code	**NETF4**	

Criteria and justification

Environmental need: Lift trucks other than rough terrain trucks are numerous and can operate near dwellings.

Environmental impact: EI= 65 (high) which justifies the proposal of a limit value.

Technical feasibility: The fan and engine are main noise sources, both possible to reduce in level.

Economic impact: Small, as engine configuration is similar to rough terrain lift trucks.

Other remarks: Distinction between Article 12 types (36a) and Article 13 types (36b) is easily misinterpreted.

39 . Mobile waste containers

	Stage 1	Stage 2
Nomeval	100	95
WG7	100	95
ODELIA	**100**	**95**
Decision code	**NETF4**	

Criteria and justification

Environmental need: Impact and rolling noise occur both when containers are used at the dwelling (slamming of lids), taken to and from the street, and handled during waste collection. The high numbers of this equipment, impact noise and usage in early and late hours justifies the introduction of a limit value.

Environmental impact: EI=66 (high). Especially impacts but also rolling noise are common sources of disturbance in late and early hours.

Technical feasibility: Reduction of excitation and transmission of impact and rolling noise may be implemented. Alternative materials, damping and geometric optimisation are options. See for example quieter supermarket trolleys.

Economic impact: Solutions for noise reduction should not be too costly, especially considering the very large numbers of this product.

Other remarks: The test code should be improved and made more practical and representative of typical use.

41a. paver-finishers equipped with a high-compaction screed

Nomeval	Art. 13
WG7	Art. 13
FEM	Art. 13
ODELIA	Art. 13
Decision code	**NEL3**

Criteria and justification

Environmental need: Low as paver finishers have only a short presence during road resurfacing.
Environmental impact: EI= 42 (low).
Technical feasibility: -
Economic impact: None
Other remarks: -

42. Piling equipment

	a. Percussive
Nomeval	Art. 13, R&D: 100+11lg E, 95+11 lg E (E = strike energy)
WG7	Art. 13
CECE/2015	Art. 13
ODELIA	132
Decision code	**NETF4**

	b.Vibrating + static
Nomeval	Stage I: 115 Stage II: 112
WG7	Art. 13
CECE/2015	Art. 13
ODELIA	115
Decision code	**NETF4**

Criteria and justification

Environmental need: Piling machines can produce very high noise levels, in particular the percussive types, and are a known source of complaints mentioned by authorities. Local regulations exist to manage this noise, but noise emission limits would form an additional instrument to encourage noise abatement of the machine contribution. Although the noise emission from the pile can exceed that of the machine (hammer + structure), a well-defined test could at least reduce the machine contribution for part of the work cycle (e.g. for concrete piles or steel piles already part into the ground).
Environmental impact: EI=70 (very high). The high noise levels, especially impacts, can cause disturbance and complaints over a wide area. Lower machine population estimate than in

	Nomeval, (3000 instead of 20000) but 6 dB higher average noise level.
Technical feasibility:	Besides working practice for quiet piling, the damping and shielding of the hammer, support structure and pile itself, impact control and impact pad design are known and tested solutions. For vibratory systems, vibration isolation of the machine, force control and handling of the pile are means to reduce the noise. For static systems the energy supply system may be the strongest noise source. Before introducing these limits further data evaluation is necessary.
Economic impact:	Potentially high due to small numbers of these machines, although there is demand for quieter models as this can increase the allowable operating time. But various solutions have already been demonstrated for percussive equipment.
Other remarks:	Very little data in databases, only for percussive piling equipment. The test code should be improved and made more practical. Further data collection and evaluation is required. The proposed initial limits must be verified with more data.

43. Pipelayers

Nomeval	Remove
WG7	Art. 13
ODELIA	Art. 13
Decision code	**NEL3**

Criteria and justification

Environmental need:	Low due to limited presence and small numbers.
Environmental impact:	EI= 42 (low).
Technical feasibility:	-
Economic impact:	None.
Other remarks:	-

44. Piste Caterpillars

Nomeval	Remove
WG7	Art. 13
ODELIA	Art. 13
Decision code	**NEL3**

Criteria and justification

Environmental need:	Low due to rural use and small numbers.
Environmental impact:	EI= 32 (very low).
Technical feasibility:	-
Economic impact:	None.
Other remarks:	Rename to Snow groomers.

45b. Power generators (≥400 kW)

Nomeval	93 + 2 lg Pel
WG7	Stage I: 75 + 11 lg Pel Stage II: 93 + 2 lg Pel
EuropGen	75 + 11 lg Pel
ODELIA	75 + 11 lg Pel
Decision code	**NEMTF4**

Criteria and justification

Environmental need: Larger size generators are used in construction, backup and temporary energy supply for example for events. Some are containerised or permanently placed and are for indoor placement, being potentially out of the scope of the directive.

Environmental impact: With a medium environmental impact EI=55 due to high noise levels and relatively long operating times in a variety of environments, limit values are justified.

Technical feasibility: Technically, most generators can be designed to have very low noise levels, so cost and demand often determine the specifications.

Economic impact: Moderate impact can be expected for models currently without noise abatement.

Other remarks: *See Europgen papers.*

46 . Power Sweepers

Nomeval	P≤ 10 kW: 100	P> 10 kW: 90+11 lg P
WG7	P≤ 8 kW: 100	P> 8 kW: 90+11 lg P
EGMF	P≤ 10 kW: 100	P> 10 kW: 90+11 lg P
EUnited Cleaning	P≤ 10 kW: 100	P> 10 kW: 90+11 lg P
ODELIA	P≤ 5 kW: 96	P> 5 kW: 89+11 lg P
Decision code	**NEMTF4**	

Definition: Rename to Road Sweepers and include other types of sweepers for outdoor use and street washing machine.

Criteria and justification

Environmental need: Power sweepers can be noisy and operate in urban areas, also at night and early hours. Limits should exclude unnecessarily high noise levels.

Environmental impact: EI=50 (medium).

Technical feasibility: Quieter fans, quieter engines, quieter hydraulics and especially electronic control may be implemented.

Economic impact: Only a small part of the equipment is affected.

Other remarks: Technical parameter should be the sum of installed engine power of the main traction engine, or in the case of twin engine sweepers, the combined power of both

engines. Test code is issue.
WG7: Noise related parameter:
- Single engine truck road sweepers: Sweeping system power declared by the manufacturer;
- Multiple engine truck road sweeper: net installed power
- Single engine road sweeper (non-truck type): net installed power.
EUnited Cleaning requests definition change to road-mobile sweepers as in EN 15429-1 (Art 12) and non-road mobile sweepers as in EN 60335-2-72 (Art 13).
EUnited Municipal Equipment: Change definition to road surface cleaning machines (according to EN 15429-1); distinguish from other sweeping machines (such as EN 60335-2-72).

47 . Refuse collection vehicles

Nomeval	First stage 107, Second stage 104
WG7	Art.13 due to test code
EUnited	Art.13 due to test code
ODELIA	105
Decision code	**NETF4**

Criteria and justification

Environmental need: Refuse vehicles operate regularly in all areas, sometimes at late or early hours being a potential cause of sleep disturbance or annoyance. Limits should exclude unnecessarily high noise levels and preferably include all the relevant noise sources including the truck engine.

Environmental impact: EI=62 (high).

Technical feasibility: Quieter engines, quieter hydraulics, electronic control and impact smoothing may be implemented. Hybrid vehicles already in use. If installed power is to be used as technical parameter, this should include vehicle engine.

Economic impact: Quieter vehicles are already on the market, therefore limited impact.

Other remarks: The noise test code is not representative of the work cycle. The proposed noise limit should be reconsidered when the test code is updated to full cycle test, including the lifting and emptying of bins and lowering.

48. Road milling machines

	P ≤ 55 kW	P > 55 kW
Nomeval	105	86 + 11 lg P
WG7	mw<1m: first stage 108 second stage 105 mw≥1m: rest in Art. 13	
CECE	87+11lgP	
CECE/2015	Art. 13	
ODELIA	Art 13	
Decision code	**NEL3**	

Criteria and justification

Environmental need: Road milling machines only appear when roads are resurfaced, once in 5-20 years.

Environmental impact: EI=44 (low). Nomeval estimate for numbers reduced significantly to 5000 based on CECE estimate.

Technical feasibility: -.

Economic impact: None as unchanged

Other remarks: Technical power is still technical parameter, but milling width is an additional grouping criterium.

49. Scarifiers

Nomeval	97 + 2 lg P
WG7 CE Electric	Stage I: 99 + 2 lg P Stage II: 97 + 2 lg P Art. 13
EGMF	Art. 13 due to short usage and low numbers
ODELIA	99 + 2lgP
Decision code	**NEMTF4**

Criteria and justification

Environmental need: Scarifiers are much less numerous than lawnmowers but in sufficient numbers and with noise levels to justify noise limits. Electric models are also included as process or flow noise may contribute.

Environmental impact: EI=55 (medium).

Technical feasibility: Scarifiers can probably work at lower tool speeds than lawnmowers.Different working principles are used.

Economic impact: Small as many will comply.

Other remarks: Databases also contain some surface scarifiers for stone and asphalt, quite noisy machines, but these do not fit in the current definition.

50. Shredders/chippers

Nomeval	Inlet ≤ 200 mm:	Inlet>200mm :
CE Electric	109 99	86 + 11 lg P
WG7	Art. 13 Remove from directive inlet>250mm	
CEMA	Art. 13	
ODELIA	P≤ 5 kW	P> 5 kW
	109	119
Decision code	**NETF4**	

Criteria and justification

Environmental need: Some types of shredders and chippers can be very noisy. Most types can also operate in or near residential areas, for clearing trees and branches. They are mentioned by authorities as a known source of annoyance. Limits should exclude unnecessarily high noise levels and stimulate quieter products.

Environmental impact: EI=65 (high) .

Technical feasibility: In the lower power ranges both electric and CE driven types are found, the quietest types being the electric worm drive shredders. The rotating knife and drum types tend to be noisier. The medium and higher power ranges contain mostly CE powered shredders/chippers, either self-powered or tractor-powered. Some of these have a blow-off shute and are trailer-mounted. Some have enclosures and other measures to reduce the noise. Noise reduction is considered feasible as many lower noise types are already on the market using known solutions.

Economic impact: More than 70% of machines in the database will pass the limits, which are proposed at a rather high level to allow for the wide variety in equipment types. As the technology is available, the economic impact is deemed to be limited.

Other remarks: Electric machines are not given separate limits as the process noise is dominant, often exceeding the noise from CE-powered types, justifying a single limit. The test code is an issue.

CEMA suggests to differentiate between electric and petrol engine driven shredders below 5 kW as the proposed limit of 109 dB is not considered feasible for petrol engine powered machines, and therefore a higher limit is suggested. Also for the larger machines a higher limit is suggested to allow for machines that can process large branches.

51 . Snow removing machines with rotating tools

Nomeval	Art. 13
WG7	Art. 13
EUnited	Art. 13
ODELIA	Art. 13
Decision code	**NEL3**

Criteria and justification

Environmental need: This equipment can cause some disturbance in areas with cold winters and close to dwellings, but infrequently, only after snowfall.

Environmental impact: EI=29 (very low)

Technical feasibility: -.

Economic impact: -.

Other remarks: EUnited Municipal Equipment: Large snow removal machines with rotating tools according to EN 15906, such as snow cutters and snow blowers, which are used i.e. to remove big snow masses from rural roads, highways and mountain roads should be removed from the directive.These machines are not comparable to small ride-on or walk behind snow throwers according to ISO 8437. Estimations under 'Environmental noise impact' are not applicable to snow removal machines with rotating tools acc. to EN 15906. Their environmental impact is extremely low because of the seasonal application at a few days per year only after extreme snowfalls on rural roads, highways and mountain roads. The population is only a few hundred and not comparable to walk behind snow throwers.'

52. Suction vehicles

Nomeval	Combine with 7 and 26.
WG7	109
ODELIA	Combine with 7 and 26.
Decision code	**NEMTF4**

Criteria and justification

Environmental need: Low due to rural use and small numbers.

Environmental impact: EI= 45 (low) but medium when combined with 7. And 26.

Technical feasibility: See equipment type 7.

Economic impact: None.

Other remarks: -

54. Trenchers

Nomeval	Remove
WG7	Art. 13
ODELIA	Art. 13
Decision code	**NEMTF4**

Criteria and justification

Environmental need: Low due limited use and presence.
Environmental impact: EI= 46 (low).
Technical feasibility: -
Economic impact: None.
Other remarks: -

55. Truck mixers

	P≤55 kW	P>55 kW
Nomeval	101	85 + 11 lg P
	P≤30 kW	P>30 kW
WG7	101	85 + 11 lg P
CECE/2015	Art. 13	
	P≤55 kW	P>55 kW
ODELIA	109	90 + 11 lg P
Decision code	**NEMTF4**	

Criteria and justification

Environmental need: Truck mixers can produce high noise levels in urban areas near dwellings and operate at high engine rpm during full power mixing (about 80 hours/year).
Environmental impact: EI=48 (medium), taking into account only the high engine rpm operating time.
Technical feasibility: The proposed limit, which is much higher than previous ones, is considered feasible given the EU heavy truck noise limit with 3 dB increase to account for process noise. Technical parameter for vehicles with PTO is installed engine power, otherwise auxiliary engine power.
Economic impact: Small as limits well exceed EU heavy truck noise limits.
Other remarks: Limits can be compared to 2014 EU limit for pass-by test value for heavy trucks > 250 kW.
$L_W = L_{pAFmax} + 10 \lg (2\pi r^2) = 81+25.5=106.5$ dB(A) (r=7.5 m)
Truck engine power + auxiliary power should be used as technical parameter, see the very limited selected data from databases. More data is required to assess the limit proposal.

56. Water pump units (not for use under water)

	P≤35 kW	P>35 kW
Nomeval	99	82 + 11 lg P
WG7	Art. 13	
ODELIA	P≤25	P>25
CE	109	94 + 11 lg P
Electric	99	
Decision code	**NETF4**	

Criteria and justification

Environmental need: Water pumps are used in a wide variety of applications both for professional and private use. Both electric and CE powered pumps are on the market. Many portable CE-powered models have unenclosed engines.

Environmental impact: EI=57 (high), large numbers and in some cases long operating times.

Technical feasibility: The proposed limits are considered feasible based on the databases which have many entries.

Economic impact: Some of the open CE models will be affected, requiring quieter pumps and engines and/or partial damping or encapsulation.

Other remarks: Expand definition to include swimming pool pumps.

7 New equipment for Article 12/13 and potential limits

This chapter addresses the question whether any new equipment types meet the generic description of ‘equipment for use outdoors’ in Article 3(a) or a foreseeable adaptation of this description, with a view to whether it is appropriate for any, or all of this equipment to be assigned limit values in a future Regulation and, if so, what these should be.

For new equipment types the scope of the OND must be considered, set out in section 2.3. The starting point for the list of potential new equipment to add to the Directive is the list produced in the Nomeval study, reconsidered in the light of current information. No real additional new types have been identified since the Nomeval study. These potential equipment types are listed with the same numbering as in Nomeval, starting from no.100, an arbitrary number to distinguish from the equipment numbers already in the directive. Some are now covered by other EU legislation or can easily be combined with existing types in the OND by expanding definitions.

Besides the environmental impact indicator, the decision diagram for new equipment includes the member state request box 'Severe local noise problems in one Member State' . As for equipment in Art.13, this criterion is considered a sufficient justification for noise limit in those cases where a significant amount of complaints and/or member state requests are made for specific types of equipment whose use and negative effects are predominant only in some member states. In such a cases, indeed, the environmental impact indicator turns out to be inadequate as it is calculated taking into account the number of noise exposed persons across Europe. In the proposed list of potential new equipment to add to the Directive, only snowmobiles fall into this category.

The new equipment types are set out below together with the considerations as to whether they belong in the scope of the directive and if so, whether their inclusion is justified. Excluding the case of snowmobiles, the environmental impact indicator is the main parameter used for this justification. Where equipment is proposed to be combined with an existing category, the environmental impact of the whole category is used.

A comprehensive overview of the proposed limits for all equipment types including the new ones is given in Chapter 9.

100. Airco/ ventilation equipment
101. Heat pumps

Nomeval	Article 12 limits recommended, but to be investigated.
ODELIA	These equipment types do not need to be included in the OND as they are now covered by the Ecodesign Directive. Commission Regulation (EU) No 206/2012 specifies an outdoor sound power level of 65 dB(A) for a rated capacity ≤ 6 kW 70 dB(A) for a rated capacity above 6 kW and below 12 kW.
Decision	**Not to be included**

Environmental impact: Estimated environmental impact is EI=63 (high) for Airco systems due to large numbers, but very low for heat pumps, EI=26 due to low noise levels and lower numbers.

102. Mobile sieve installations
103. Mobile waste breakers (wood, concrete)

Nomeval	Introduce in Art. 13, follow by 84 + 11 lg P
WG7	Do not include
CECE/2015	Reject due to process noise, large variety of equipment, low relevance for noise and lack of test code.
ODELIA	Introduce in Art. 13, later evaluate for limits Possibly: 112; 92+11 lg P
Decision code	**CNETR6**

Criteria and justification

Environmental need: Large noisy machines operating for limited times in urban and other areas. Despite other environmental benefits they introduce a new noise source.

Environmental impact: EI=49-54 (medium) , due to high noise levels sometimes in urban areas.

Technical feasibility: A reduction of noise levels should be possible using established methods such as impact reduction, quieter engines and cooling, partial shielding and damping. Process noise should also be reduced.

Economic impact: May be moderate due to the variety of machine types and the initial effort to improve designs.

Other remarks: Large variety with different working principles and question of operating condition and materials for test. Lack of test code should be addressed.

104. Tractors for construction / water pumps

Nomeval	Add stationary noise limit at high rpm in existing regulation
WG7	-
CEMA	No additional limits
ODELIA	Add stationary noise limit at high rpm in existing regulation
Decision code	**CNEL5**

Criteria and justification

Environmental need: Tractors are widespread, also in urban areas for park and street maintenance, water pumping, mowing and construction, often with attachments or trailers, and can be a source of complaints.

Environmental impact: 56 (medium).

Technical feasibility: Depends on the limit, to be evaluated.

Economic impact: Depends on limit.

Other remarks: Tractors are covered in Regulation 167/2013/EC and 2009/63/EC for Tractors, which sets limits only for pass-by noise L_{pAFmax}. Stationary noise is measured but no limit set. As double regulation should be avoided, it should be considered to set a limit for stationary noise with high rpm in the existing regulation.

105. Reverse movement alarm signals (all machines)

ODELIA	Outside of scope as it is a component and intended to produce noise. High environmental impact estimated at EI=73.
Decision code	**Not to be included**

106. Non-fixed lifting gear, own power source

ODELIA	Outside of scope as insufficiently defined. Low environmental impact estimated at EI=46.
Decision code	**CNEL5**

107. Portal cranes for harbours and terminals

Nomeval	Art 13.
WG7	Reject due to local regulation
FEM	Reject due to local regulation
ODELIA	Art 13.
Decision code	**CNEL6**

Criteria and justification

Environmental need: Ports and freight terminals continue to expand, in some cases near residential areas, which also grow. Night time operation and multiple units can together cause a

noise problem under unfavourable propagation conditions.
Environmental impact: 56 (medium).
Technical feasibility: No issue for Art 13.
Economic impact: Small, mainly the testing.
Other remarks: Test code and practical execution of the test are an issue.

108. Vehicle mounted loader cranes

Nomeval	Art 13.
WG7	Reject due to local regulation
FEM	
ODELIA	Include with 38. Mobile cranes with the same noise limit.
Decision code	**C8 (NEMTF2)**

Criteria and justification
Environmental need: Vehicle mounted loader cranes are numerous and are often heard during goods delivery in urban areas, due to high rpm stationary operation of the vehicle engine.
Environmental impact: 53 (medium).
Technical feasibility: Feasible within the limits for mobile cranes as the vehicle engine is the main noise source, and limits should be consistent with pass-by limits for heavy vehicles.
Economic impact: Small as the test and noise declaration should be performed by the manufacturer who installs the crane on the vehicle.
Other remarks: FEM states that due to different design and application of loader cranes they should not be combined with mobile cranes (noting the difference with vehicle mounted cranes that can be regarded as mobile cranes)

109. Walk-behind road sweepers, no aspirators (motorized broom)

Nomeval	Too low numbers to include
WG7	Include with road sweepers
EUnited Cleaning and EUnited Municipal Equipment	Do not include in Article 12 due to low environmental impact. This equipment falls under EN 60335-2-72.
ODELIA	Combine with 46. and 110.
Decision code	**C8 (NEMTF4)**

Criteria and justification
Environmental need: Walk behind sweepers are used in urban areas on squares and in parks.

Environmental impact: EI=41 (low), but included with road sweepers, EI=50 (medium).
Technical feasibility: As for sweepers.
Economic impact: As for sweepers.
Other remarks: Include with road sweepers. Improve definition if necessary for walk behind sweepers. The EN 12733 definition is: A pedestrian controlled, self-propelled machine, with front mounted sweeping attachments, with sweeping and/or collecting system.
EUnited Cleaning: distinction by standards.
EUnited Municipal Equipment: Walk-behind sweepers fall under EN 60335-2-72.

110. Street washing machine

Nomeval	Too low numbers to include (separately)
WG7	-
EUnited	
ODELIA	Include with road sweepers, updating definition. 'Street sweepers and washers' Combine with 46. and 109.
Decision code	**C8 (NEMTF4)**

Criteria and justification
Environmental need: Street washing machines are often combined with sweepers which have a known impact.
Environmental impact: EI=46 (low), but included with road sweepers, EI=50 (medium)
Technical feasibility: Noise of water spray system must be taken into account.
Economic impact: Unknown, depending on the options for water spray systems.
Other remarks: -

111. Snowmobiles

Nomeval	(L_{WA}) First stage: 107 Second stage: 105
WG7	L_{pASmax} @ 15.2m, accelerating First stage 78 Second stage 75
ISMA	L_{pASmax} @ 15.2m, accelerating 78
ODELIA	L_{pASmax} @ 15.2m, accelerating 78 Convert to LW for label $L_W=L_{pASmax}$ + 31.6 = 110
Decision code	**CNTF7**

Criteria and justification

Environmental need:	Specific request from Sweden and relevant for all Nordic and mountainous countries. Snowmobiles cause considerable local disturbance in rural areas during recreational use. This may in part be due to tampered exhausts and to particular driving behavior, but it is nevertheless required to set basic limits despite very low calculated environmental impact. Without limits there will be little incentive for quieter machines.
Environmental impact:	34 (very low), but if tampered exhausts are taken into account, probably around 50 (medium).
Technical feasibility:	Feasible, based on available literature, see 2007 study from Finland [77] and [75].
Economic impact:	Small as already achievable for some current models.
Other remarks:	Test code SAE J 192, Jan. 2013, but convert L_{pAS} to sound power to allow labelling. Scope issue: Transport of persons is not consistent with the scope of the OND.

112. Quad (off-road)

Nomeval	Other legislation
ODELIA	Covered by EU Directive 97/24/EC. Environmental impact EI = 35 (low), but if tampered exhausts are taken into account, probably around 50 (medium).
Decision	**Not to be included**

113. Golf green edger

Nomeval	Not to include due to very low impact
ODELIA	Fits in the scope of the OND. Environmental impact EI=12 (very low), so not to be included, also as golf courses mostly do not have many residents in the direct vicinity.
Decision code	**CNEL5**

114. Bird scare canons/Gas guns

Nomeval	Not to include due to low impact
ODELIA	Gas guns are considered to be outside of scope of the OND, as this is a device with the main function of making noise. There is a severe local environmental impact in some member states, due to continuous impact noise during summer months near dwellings from dusk to dawn. Often failure of local authorities to apply/enforce legislation and guidelines, which cannot be remedied by the OND. The OND does not ban equipment or set limits effectively excluding the majority of models.
Decision	**Not to be included**

115. Telescopic or pole pruner a. CE-powered b. Electric

Nomeval	Include with chainsaws (6).
WG7	Reject
EGMF	Rejects due low usage and small numbers
ODELIA	Include with chainsaws (6) as subgroups should not be automatically excluded and numbers will increase.
Decision code	**C8 (NETF4 / NETF4)**

Criteria and justification

Environmental need: The small engines and tools used at greater height can be a source of disturbance. Variants of this type of equipment and all sorts of attachments are increasing, and if they include a chain saw, should be grouped with chainsaws.

Environmental impact: 49 (medium).

Technical feasibility: Similar to chainsaws, although mostly small due to more weight constraints.

Economic impact: Same as for chainsaws.

Other remarks: EGMF rejects including these with chainsaws due to their low numbers and short usage time.

116. Tree stump grinder

Nomeval	Not to be included
WG7	No mention
EGMF	Do not include due to low numbers
ODELIA	Not to be included
Decision code	**CNEL5**

Criteria and justification

Environmental need: Very small number of equipment, so no major issue. But noise levels can be high.
Usage also in urban areas for tree root removal.

Environmental impact: EI=20 (very low)

Technical feasibility: -

Economic impact: None

Other remarks: Re-assess later whether numbers increase, possible to include with shredders/chippers (some declarations in databases already in with shredders).

117. Straddle carrier and 118. Reach stacker

Nomeval	Include with Loaders and Lift trucks
WG7	Rejects due to use only in permit areas
FEM	Rejects due to use only in permit areas
ODELIA	Include with 36. Lift trucks
Decision code	**C8 (NETF2)**

Criteria and justification

Environmental need: Ports and freight terminals continue to expand, in some cases near residential areas, which also grow. Night time operation and multiple units can together cause a noise problem under unfavourable propagation conditions.

Environmental impact: Straddle carrier EI = 31 (very low), Reach stacker EI = 42 (low) , but lift trucks = 59 (high).

Technical feasibility: This equipment type is larger and heavier than most lift trucks and therefore has more potential for noise reduction.

Economic impact: Less than for lift trucks.

Other remarks: Data collection and verification required.

119. Handheld stone cut-off saw

Nomeval	First stage: 112 + 2*P Second stage 110 + 2*P
WG7	Do not include
EGMF	Art 13, separate from joint cutters
ODELIA	112 + 2*P
Decision code	**CNETF7**

Criteria and justification

Environmental need: Stone cut-off saws, especially handheld ones, are increasingly present in urban areas and produce high noise levels.

Environmental impact: EI = 63 (high).

Technical feasibility: Quieter diamond blades and quieter engines available.

Economic impact: Should be limited if existing technology is applied.

Other remarks: Actually fits in to the definition of 30. Joint cutter, but EGMF prefers to put handheld units into a separate group.

120. Stone chainsaw

Nomeval	Include with chain saws
WG7	Rejects
EGMF	Keep separate due to low numbers and limited usage.
ODELIA	Include with chain saws
Decision code	**C8 (NETF4 / NETF4)**

Criteria and justification

Environmental need: Stone chainsaws are used for special construction tasks such as cutting walls, pavements or pillars. Also for use by emergency services.

Environmental impact: EI = 54 (medium) due to the high noise level.

Technical feasibility: Data on internet seems to show that limits for chainsaws (6) are feasible.

Economic impact: Should be limited as machines fulfilling limits are already on the market.

Other remarks: Limits can be the same as for chainsaws. Definition should be modified to include stone: 'A power-driven tool designed to cut wood or other materials including stone, cement or breeze blocks…'
EGMF rejects including these in the directive as it is a niche product with a low population.

121. Swimming pool pumps

Nomeval	Include with water pumps
WG7	Include with water pumps
ODELIA	Include with water pumps
Decision code	**C8 (NETF4)**

Criteria and justification

Environmental need: Swimming pool pumps are often electric, but sometimes portable CE-powered water pumps are used. Despite infrequent use, the duration can be long enough to cause annoyance.

Environmental impact: EI = 40 (low) due to the moderate level noise level assumed for electric pumps, but higher for CE-powered pumps.

Technical feasibility: Same considerations as for other water pumps.

Economic impact: Same considerations as for other water pumps if put into Article 12.

Other remarks: Improve water pump definition if necessary, '…including swimming pool pumps…'.

122. Air suction refuse clearing vehicles

ODELIA	Include with 7. Combined high pressure flushers and suction vehicles
Decision code	**C8 (NEMTF4)**

Criteria and justification

Environmental need: New models of air suction refuse clearing vehicles have appeared.

Environmental impact: EI = 49 (medium) same as for equipment type 7.

Technical feasibility: Same considerations as for equipment type 7.

Economic impact: Same considerations as for equipment type 7 if put into Article 12.

Other remarks: Update definition of equipment type 7. High pressure flushers or suction vehicles, with 'including Air suction vehicles for refuse clearing'.

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8 Review of test methods

The detailed description of the test methods in the directive serves to determine comparable and reproducible values of the sound power level of the listed equipment. A reliable test method is necessary for the equipment listed under Article 12 for the comparison with the limit values and the evaluation of the EU database. This is why the measuring methods in the OND and the international and European standards were specified for each equipment type individually.

15 years on from the introduction of the OND, some of the standards it refers to are no longer valid or available. Some have been revised or replaced, also in view of reproducibility.

The review of test methods was carried out according to the decision flow charts for test methods for equipment types currently in Art. 12 and Art. 13, figure 3d, and the decision flow chart for equipment types currently outside the scope of the Directive, figure 3e in section 2.3.

The first criterion in the decision flowcharts “Is there any revised version of the test method?” also summarises the review of the test code considering the actual use of the machine, repeatability and reproducibility and the criterion whether the test code is adapted to the specific type of equipment (comment from FEM).

The recommendations are mainly based on existing regulations. Also the recommendations from stakeholders are taken into account if new test codes are being developed.

New or modified test codes can result in changes in the measured values. This is generally acceptable as long as the correlation of the measured values obtained with the old and new test codes is taken into account both in adjusting the noise limit values (Art. 12 equipment) or in introducing noise limits (Art.13 equipment).

Required adjustments of the test codes are included in the tables below for each equipment type. The definition of the required changes of the test codes is beyond the scope of this study. Further investigations and comparative measurements are necessary to assess this. Issues to be covered include:

- Improvement of existing test codes for reproducibility, either in the Directive itself or in the relevant standard(s);
- Application of new or revised standards;
- Proposed modifications to the standard and/or operating conditions.

Essentially, it is proposed that the OND should refer to the following standards for the test codes, offering clear advantages for repeatability and reproducibility:

- ISO 3744: 2011 for sound power measurement;
- ISO 22868: 2011 for sound pressure and sound power measurement of portable, hand-held combustion engine powered forestry and garden machines;
- EN 500-4: 2011 for safety of mobile road construction machinery (including environmental noise);
- ISO 6395: 2008 for sound power measurement of earth moving machinery under dynamic operating conditions.

- UN ECE R120: its measurement method and conditions should be used for the definition of power of internal combustion engines.

Recommended improvements for each equipment type are based on the most recently available information from CEN and stakeholders. Stakeholder comments are included here and not in the datasheets in appendix F. The information from the Nomeval study, notified bodies and WG7 are included, but taking into account the partly outdated regulations, which are not listed separately. They have been taken into account in the ODELIA proposal. For all test codes the ISO 3744:1995 shall be replaced by ISO 3744:2011.

1	**Aerial access platforms with combustion engine**
Current	ISO 3744:1995
ODELIA	ISO 3744:2011

Comments:

Odelia	No better test code available.
FEM	The current test code should be amended to suit to the actual usage of machine (most of the time with engine switched off).

2	**Brush cutters**
Current	ISO 10884:1995
CEN WP M 373	TC 144
ODELIA	ISO 22868: 2011

Comments:

Odelia	Clear advantages compared to ISO10884 (1995) in terms of repeatability and reproducibility.
CEN	ISO 22868:2011 (Next SR in 2016 - ISO/TC 23/SC 17)
EGMF	ISO 22868:2011

3a	**Builders' hoists for the transport of goods (combustion-engine driven)**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

3b	**Builders' hoists for the transport of goods (with electric motor)**
Current	2000/14/EC
CEN WP M 373	TC 10
ODELIA	No change

Comments:

Odelia	No better test code available.

4	**Building site band saw machine**
Current	ISO 7960:1995
CEN WP M 373	TC 142
ODELIA	No change

Comments:

Odelia	No better test code available.

5	**Building site circular saw bench**
Current	ISO 7960:1995
CEN WP M 373	TC 142
ODELIA	No change

Comments:

Odelia	No better test code available.

6	**Chain saws, portable**
Current	ISO 9207:1995; 2000/14/EC
CEN WP M 373	TC 144
ODELIA	ISO 22868:2011

Comments:

Odelia	Clear advantages compared with ISO9207 (1995) in terms of repeatability and reproducibility.
CEN	ISO 22868:2011 (Next SR in 2016 - ISO/TC 23/SC 17)
EGMF	CE-powered: ISO 22868:2011 electric powered: EN 62841-4-1 (expected for 2017)

7	**Combined high pressure flushers and suction vehicles**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

8a	**Compaction machines (explosion rammers only)**
Current	EN 500-4 rev. 1:1998
CEN WP M 373	TC 151
ODELIA	Remove acc. to EN 500-4:2011

8b	**Compaction machines (only vibrating and non-vibrating rollers, vibratory plates…**
Current	2000/14/EC; EN 500-4 rev. 1:1998
CEN WP M 373	TC 151
ODELIA	EN 500-4: 2011; Divide into 4 subgroups

Comments:

Odelia	Comments from NB Sub-Group: ISO 6395:2008 Annex L brings insignificant higher noise test results. Test with rated speed is more reproducible and should be preferred (EN 500-4:2006).
CEN	EN 500-4:2011

9	**Compressors (< 350 kW)**
Current	ISO 3744:1995
ODELIA	EN ISO 2151:2008

Comments:

Odelia	Now EN ISO 2151:2008 is available

10	**Concrete-breakers and picks, hand-held**
Current	2000/14/EC
ODELIA	Only >3kg, as small tools are used privately and mainly indoors;EN 60745-2-6:2010

Comments:

Odelia

Comments from HSL (Health and Safety Laboratory, UK) on EN60745-2-6(2010): About the required test rig: “it was difficult, and in some cases impossible, to comply with all of the requirements because of omissions and technical difficulties with the specified standard test” About test method: “Omissions and technical difficulties in the defined test method are identified. It may be possible to amend the test code in a way that does not change the requirements of the regulations.

Pneurop

The ODELIA proposal to include only those powered tools above 3kg is welcomed. With the reference to EN 60745-2-6 this then raises the issue of its use as an industry code if the Current test methods included in 2000/14/EC, Annex III: Part B-item 10 area removed in favour of this standard. This is due to the fact that the standard uses two loading devices, i.e. concrete block and a dynamic loading device.

The dynamic loading device (Dynaload) was included some years ago in a European Commission funded Round Robin test to establish its ability to replace the Current concrete block device at the time when the OND was being developed from the original Construction Site Noise Directives. The result of the Round Robin established that the Dynaload had a noise signature slightly higher than the concrete block and was not therefore adopted for use in the OND.

In EN 60745-2-6 the choice between which of the 2 devices is used is done by 'blow-energy' in Joules. The categories in the OND are only described in mass as Kg. In EN 60745-2-6:2010 a machine with power equal or less than 20 Joules is defined as a chiselling hammer and should be measured according to the Dynaload.

This raises the question that if the ODELIA proposal to include all tools above 3kg then how, if EN 60745-2-6 is to be stipulated in the OND, are we to determine if a tool above 3kg has a blow energy of 20 joules or less so that the standard is used as its Scope allows?

There are 2 options either the Directive states which loading device is used in the standard or the standard is revised so that the loading device is selected according to the mass of the power tool. With the Dynaload's inherent higher noise signature PNEUROP would not support the use of a standard that allowed such an option.

The standard also indicates that the measurements may be either 3 no-load or 5 on-load. This is not in-line with the OND which specifies 3 on-load measurements, providing that at least two of the measured values differ by no more than 1 dB. This is also an area where either the OND or the standard needs to be modified to maintain certainty for the manufacturer for the measurement process.

11	**Concrete or mortar mixers**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	No change

Comments:

Odelia	No better test code available.
CEN	EN 12151:2007

12a	**Construction winches (combustion-engine driven)**
Current	ISO 3744:1995
CEN WP M 373	0
ODELIA	No change

Comments:

Odelia	No better test code available.

12b	**Construction winches (electrically driven)**
Current	ISO 3744:1995
ODELIA	No change

Comments:

Odelia	No better test code available.

13	**Conveying and spraying machines for concrete and mortar**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	No change

Comments:

Odelia	No better test code available.; EN 12001 does not describe a test code meeting the requirements of OND.
CEN	EN 12001:2003+A1:2009
CECE	EN 12001:2012 is available

14	**Conveyor belts**
Current	ISO 3744:1995
ODELIA	No change

Comments:

Odelia	No better test code available.

15	**Cooling equipment on vehicles**
Current	2000/14/EC
CEN WP M 373	0
ODELIA	EN 12102: 2013

Comments:

16	**Dozers (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex C

Comments:

Odelia	Comments from NB Sub-Group: No differences between the new and old test codes
CEN	EN 474-2:2006+A1:2008, ISO 6395:2008

17	**Drill rigs**
Current	EN 791:1995
CEN WP M 373	TC 151
ODELIA	No change

Comments:

Odelia	No better test code available.
CEN	EN 16228-1:2014, EN 16228-2:2014
CECE	reference should be given to EN ISO 3744 according to EN16228-1 to 7

18	**Dumpers (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395 2008 Annex F

Comments:

Odelia	Comments from NB Sub-Group: ISO 6395:2008 brings up to 1.5 dB lower noise test results, but it is more typical for the use of dumpers on construction sites. If LWA is calculated from 90% forward driving and 10% dumping, nearly the same values as before are obtained.
CEN	EN 474-6:2006+A1:2009; ISO 6395:2008;But withdraw low idle mode and calculate 90% driving and 10% stationary work cycle

19	**Equipment for loading and unloading silos or tanks on trucks**
Current	2000/14/EC
ODELIA	Use test Code for Compressors: (Eq.No. 9)

Comments:

20	**Excavators, hydraulic or rope-operated (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex A

Comments:

Odelia	Comments from NB Sub-Group: No differences between the new and old test codes
CEN	EN 474-5:2006+A3:2013; ISO 6395:2008

21	**Excavator-loaders (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex D

Comments:

Odelia	Comments from NB Sub-Group: No differences between the new and old test codes
CEN	EN 474-4:2006+A2:2012; ISO6395:2008

22	**Glass recycling containers**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

23	**Graders (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex G

Comments:

Odelia	Comments from NB Sub-Group: No differences between the new and old test codes; The reverse drive operating condition in 2000/14/EC is unrealistic and difficult to realize
CEN	EN 474-8:2006+A1:2009; ISO6395:2008

24	**Grass trimmers/grass edge trimmers**
Current	ISO 10884:1995
CEN WP M 373	TC 144
ODELIA	ISO 22868: 2011

Comments:

Odelia	Clear advantages compared with ISO10884 (1995) in terms of repeatability and reproducibility.
CEN	ISO 22868:2011 (Next SR in 2016 - ISO/TC 23/SC 17)

25	**Hedge trimmers**
Current	ISO 11094:1991; 2000/14/EC
CEN WP M 373	TC 144
ODELIA	ISO 22868: 2011

Comments:

Odelia	Clear advantages in terms of repeatability and reproducibility.
CEN	ISO 10517:2009/Amd 1:2013 (Ongoing NP within ISO/TC 23/SC 13)
EGMF	CE-powered: ISO 22868:2011 (results in higher values for the measured values) *Electrically powered: EN 60745-2-15* *(will change to EN 62841-4-2 in the future)* Change of the measurement conditions may increase the measured sound power level with the change of the standard

26	**High pressure flushers**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

27	**High pressure water jet machines**
Current	2000/14/EC
ODELIA	<3kW:EN 60335-2-79: 2012; >=3kW: EN1829-1:2010; Test Code is the same in both

Comments:

EGMF	< 3 kW: EN 60335-2-79:2012; ≥ 3kW: EN 1829-1:2010
EUnited	References to standards are wrong. Distinction is not made by power consumption but by pressure rating. Power limit related to electric drive power consumption. Power needed to heat water shall not be considered. ≤ 35 MPa: EN 60335-2-79 > 35 MPa: EN 1829-1 Expected publication 2016 for new EN1829-1 for commercial products only.

28	**Hydraulic hammers**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	No change

Comments:

CEN	CEN/TS 13778:2008 has been withdrawn

29	**Hydraulic power packs**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

30	**Joint cutters**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	EN 13862: 2010

Comments:

CEN	EN 13862:2001+A1:2009
EGMF	Joint cutters: ISO 13862 ; Cut-off saws:ISO 19432: 2012 includes definition

31	**Landfill compactors, loader-type with bucket (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex H

Comments:

Odelia	Comments from NB Sub-Group: No influence on the noise test results. The test site in 2000/14/EC should be the combination of hard reflecting plane and sand for compactors with steel wheels fitted. The operating conditions of 2000/14/EC are unrealistic (no stationary hydraulic mode in practice).
CEN	EN 474-11:2006+A1:2008

32	**Lawnmowers (excluding agricultural and forestry equipment, …)**
Current	ISO 11094:1991
ODELIA	No change

Comments:

Odelia	No better test code available.
EGMF	Combustion: EN ISO 5395-1/-2/-3: 2013 Electric: EN 60335-2-77 Measurement according to the product standard (change in microphone positions)

33	**Lawn trimmers lawn edge trimmers**
Current	ISO 11094:1991
ODELIA	No change

Comments:

Odelia	No better test code available.
EGMF	Test code shall be changed to the product specific standard EN 50636-2-91

34	**Leaf blowers**
Current	ISO 11094:1991; 2000/14/EC
CEN WP M 373	TC 144
ODELIA	EN15503: 2014

Comments:

CEN	EN 15503:2009+A1:2013 (A2 to be submitted to formal vote in 2015)
EGMF	CE-powered: ISO 22868:2011 (next revision of EN 15503 will refer to ISO 22868) electric powered: EN 50636-2-100

35	**Leaf collectors**
Current	ISO 11094:1991; 2000/14/EC
CEN WP M 373	TC 144
ODELIA	EN15503: 2014

Comments:

EGMF	CE-powered: ISO 22868:2011 (next revision of EN 15503 will refer to ISO 22868) electric powered: EN 50636-2-100; the electric machines need to be handled differently in the noise measurement as they have e.g. no idling.

36a/b	**Lift trucks, CE driven, counterbalanced**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available. (the test code in EN 12053 does not meet the requirements of the OND, i.e. only 4 measurement points)
FEM	The various types of equipment are used for typical applications and environments. Thus the work cycles are different and need to be adapted to better reproduce the real use of the machine and its impact on the environment. This justifies the revision of the test code for each type of lift trucks. This also justifies that lift trucks cannot be in the same group with loaders. FEM proposes the following revision of the test codes (as already included in previous position paper) · Vertical mast lift trucks : use EN 12053. This standard includes the manoeuvring mode which is part of a typical work cycle of the machine. · Rough-terrain vertical mast lift trucks: EN 1459-7 under preparation · Rough-terrain variable reach trucks : EN 1459-7 under preparation (based on WG7 document 2004) · Slewing rough-terrain variable-reach trucks: EN 1459-7 under preparation · Industrial self-propelled variable reach-trucks : EN 1459-7 under preparation. The limit values shall take into account the technical possibilities and the request for quieter equipment. Today there is very little demand from the users to have quieter machines. It could be the case for specific applications. It is very challenging to fulfil the existing limits and it will be even more difficult with the future generation of engines. As a consequence there is no room for any reduction of the noise emission. The noise limits are directly connected to the test cycles. As a consequence, FEM members will evaluate the difference in the

result using the current test cycle and the proposed one. Then it will be possible to adjust the limit values.
“Idle mode” should be replaced by “manoeuvring mode” to be in line with European standard EN 12053

37	**Loaders (< 500 kW)**
Current	ISO 6395:1998
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex D

Comments:

Odelia	Comments from NB Sub-Group: No differences between the new and old test codes
CEN	EN 474-3:2006+A1:2009; ISO 6395:2008

38	**Mobile cranes**
Current	2000/14/EC
CEN WP M 373	TC 147
ODELIA	EN 13000: 2014

Comments:

CEN	Under revision
FEM	For the test code, it should refer to EN 13000, which is similar to existing test code in Directive 2000/14

39	**Mobile waste containers**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

40	**Motor hoes (< 3 kW)**
Current	ISO 11094:1991; 2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

41a	**Paver-finishers (equipped with a high-compaction screed)**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	EN 500-6: 2009

Comments:

CEN	EN 500-6:2006+A1:2008

41b	**Paver-finishers (excluding paver-finishers equipped with a high-compaction screed)**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	EN 500-6: 2009

Comments:

CEN	EN 500-6:2006+A1:2008

42	**Piling equipment**
Current	ISO 6395:1998; 2000/14/EC
CEN WP M 373	TC 151
ODELIA	EN 16228-1:2014, EN 16228-4:2014, EN 16228-7:2014

Comments:

CEN	EN 16228-1:2014, EN 16228-4:2014, EN 16228-7:2014
CECE	Test code needs improvement. The inconsistency of the Current directive does not allow to obtain a clear picture of the piling equipment noise level as the manufacturers do not apply it in the same way. It is first necessary to clarify which parts of the piling equipment shall be considered in the determining the noise emission.

43	**Pipelayers**
Current	ISO 3744:1995
CEN WP M 373	TC 151
ODELIA	ISO 6395: 2008 Annex K

Comments:

Odelia	Comments from NB Sub-Group: ISO 6395:2008 will bring insignificant lower noise test results
CEN	EN 474- 9:2006+A1:2009, ISO 6393:2008

44	**Piste caterpillars**
Current	ISO 3744:1995
CEN WP M 373	TC 151
ODELIA	EN 15059 (2009);ISO 6393(2008)

Comments:

CEN	EN 15059:2009+A1:2015, ISO 6393:2008

45a	**Power generators (< 400 kW)**
Current	ISO 8528-10:1998
CEN WP M 373	
ODELIA	ISO 8528-10:1998

Comments:

45b	**Power generators (>_ 400 kw)**
Current	ISO 8528-10:1998
ODELIA	ISO 8528-10:1998

Comments:

46	**Power sweepers**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	No change

Comments:

Odelia	No better test code available.
EGMF	Product specific standard (TC 151)

47	**Refuse collection vehicles**
Current	2000/14/EC; also in EN 1501-4
CEN WP	TC 183
ODELIA	No change

Comments:

Odelia	No better test code available.; description of test code should be replaced by EN 1501-4 (comment of EUnited)
EUnited	measurement method described in EN 1501-4 should be revised because it has only inferior relation to the development of noise emissions under real operating conditions of an RCV. Future noise emission limit values should be agreed on based on the revised noise test method.

48	**Road milling machines**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	EN 500-2:2006 + A1:2008

Comments:

CEN	EN 500-2:2006+A1:2008

49	**Scarifiers**
Current	ISO 11094:1991
ODELIA	EN 13684:2010

Comments:

EGMF	The test code shall be changed to the product specific standard EN 50636-2-92 for electric powered and EN 13684 for combustion engine powered products

50	**Shredders/chippers**
Current	ISO 11094:1991; 2000/14/EC
CEN WP M 373	TC 144
ODELIA	EN13683:2013

Comments:

CEN	EN3683:2003+A2:2011/AC:2013 ; EN 13525:2005+A2:2009; The second standard has been removed from OJEU due to formal objection and thus does not confer presumption on conformity. Review is underway with the aim of solving the FO.
EGMF	The test code shall be changed to the product specific standards: Electric:EN 50434:2014 Combustion: ISO 13683:2013

51	**Snow-removing machines with rotating tools (self-propelled, excl. attachments)**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	No change

Comments:

Odelia	No better test code available.

52	**Suction vehicles**
Current	2000/14/EC
ODELIA	No change

Comments:

Odelia	No better test code available.

53	**Tower cranes**
Current	2000/14/EC
CEN WP M 373	TC 147
ODELIA	EN 14439: 2010

Comments:

CEN	ENISO11201
FEM	The test code should refer to EN 14439, which is similar to existing test code in Directive 2000/14

54	**Trenchers**
Current	ISO 3744:1995
CEN WP M 373	TC 151
ODELIA	adopt ISO 6395 2008 Annex I

Comments:

Odelia	Comments from NB Sub-Group: ISO 6395:2008 will bring insignificant higher noise test results, but trenchers are in article 13.
CEN	EN 474-10:2006+A1:2009, ISO 6393:2008

55	**Truck mixers**
Current	2000/14/EC
CEN WP M 373	TC 151
ODELIA	No change

Comments:

Odelia	No better test code available.
CEN	No standard currently available
CECE	The expert group is preparing a project to create EN12609 as harmonized C standard. This standard will also cover the noise emission measurement for truck mixers.

56	**Water pump units (not for use under water)**
Current	2000/14/EC
CEN WP M 373	TC 197
ODELIA	EN ISO 20361:2015

Comments:

EGMF	EN ISO 20361:2015 (This standard refers to EN ISO 3744:2010) Test under load: The engine must operate at the point of best efficiency

57	**Welding generators**
Current	ISO 8528-10:1998
ODELIA	ISO 8528-10:1998

Comments:

100	**Air conditioning and ventilation equipment**
Current	n.a.
ODELIA	(EN 12102: 2013)

Comments:

Odelia	Comment from UBA: Do not include, as already regulated in 2009/125/EC

101	**Heat pumps**
Current	n.a.
ODELIA	(EN 12102: 2013)

Comments:

Odelia	Comment from UBA: Do not include, as already regulated in 2009/125/EC

102	**Mobile sieve installations**
Current	n.a.
CEN WP M 373	TC 151
ODELIA	ISO 3744

Comments:

Odelia	Difficult to determine the designated use for all the different applications.
CEN	EN standards (prEN 1009-1, -2, -3, -4, -5) in preparation
CECE	The lack of an approved standard measuring method eliminates the possibility to evaluate the Nomeval limit proposal. The Process noise level depends on how the machines are operated. There are a vast number of different operating parameters influencing the noise level. Therefore it is only possible to make regulations on emitted machine noise. The process noise is in most cases dominant. The difference between machine and process noise is typically 10 to 12 dB, which May challenge the feasibility of adding the machines to the OND. Process noise measurements are very poorly repeatable and dependent on feed material properties, size, crusher setting, fine material separation setup, construction site geometry etc. Of course you could “standardize” everything but this would not reflect the real operating environment where machines are widely adjustable and “every excavator bucket is unique”. In fast idle mode (no processed material) there is no correlation between engine power and sound power level (this is due to the fact that engine fan is the main source. The selection of fan size/type/speed depends on various factors one of which is available installation space. If the machine is compact then most likely the cooler is smaller and this may require higher fan speed)

103	**Mobile waste breakers (wood, concrete)**
Current	n.a.
CEN WP M 373	TC 151
ODELIA	ISO 3744

Comments:

Odelia	Many different working principles and types on the market. Therefore difficult to determine the designated use for all the different applications. Only loaded measurement and declaration makes sense. Testing material must be determined.
CEN	ISO 21873-2:2009; EN standards (prEN 1009-1, -2, -3, -4, -5) in preparation
CECE	See 102

104	**Tractors used in construction and for driving water pumps**
Current	n.a.
ODELIA	n.a.

Comments:

Odelia	Do not include. Covered in Regulation 167/2013/EC for Tractors.

105	**Reverse movement alarm signals (all machines)**
Current	n.a.
ODELIA	n.a.

Comments:

Odelia	Do not include, outside scope.

106	**Non-fixed lifting gear (magnets, vaccuum). own power source.**
Current	n.a.
ODELIA	n.a.

Comments:

107	**Portal cranes for harbours and terminals**
Current	n.a.
CEN WP M 373	TC 147
ODELIA	Check for scope, industrial use.

Comments:

Odelia	German standard DIN 45635 T 61 may be used to define microphone positions and test cycle; but according to FEM this does not meet the requirements of the OND.

108	**Vehicle mounted loader cranes**
Current	n.a.
ODELIA	EN 13000 (2014); the EN 12999 does not include a useful measurement procedure.

Comments:

Odelia	In practical use the CE of the chassis is the main noise source. The manufacturer of an attached loader crane has no chance to influence this. Tested with an electric driven hydraulic pump is the only possibility to get a sound power level of the loader crane itself.
FEM	Loader cranes come under the product standard EN 12999

109	**Walk-behind road sweepers, no aspirators (motorized broom)**
Current	n.a.
ODELIA	see 46 power sweepers

Comments:

110	**Street washing machine**
Current	n.a.
ODELIA	ISO 3744; Problem: Noise of Water

Comments:

Odelia Include with road sweepers, updating definition. 'Road sweepers and washers'

111	**Snowmobiles**
Current	n.a.
ODELIA	SAE J 192, Jan. 2013

Comments:

Odelia Sound power level preferred for label

112	**Quad (off-road)**
Current	n.a.
ODELIA	n.a.

Comments:

Odelia Covered by EU Directive 97/24/EC

113	**Golf green edger**
Current	n.a.
ODELIA	n.a.

Comments:

Odelia Not to be included.

114	**Bird scare canons/Gas guns**
Current	n.a.
ODELIA	n.a.

Comments:

Odelia Not to be included.

115	**Telescopic or pole pruner a. CE-powered b. Electric**
Current	n.a.
ODELIA	See 6.

Comments:

Odelia Include with chainsaws (6) as subgroups should not be automatically excluded and numbers will increase.

EGMF Exclude from OND

116	**Tree stump grinder**
Current	n.a.
ODELIA	n.a.

Comments:

Odelia Not to be included.

117	**Straddle carrier**
Current	n.a.
ODELIA	See 36

Comments:

Odelia	Include with 36

118	**Reach stacker**
Current	n.a.
ODELIA	See 36

Comments:

Odelia	Include with 36

119	**Handheld stone cut-off saw**
Current	n.a.
ODELIA	See 30

Comments:

Odelia	Fits in 30. Joint cutter
EGMF	Measurement per product specific standard ISO 19432 CE powered saws: EN ISO 5395 Electric saws: EN 60335-2-77

120	**Stone chainsaw**
Current	n.a.
ODELIA	See 6

Comments:

Odelia	Include with chain saws
EGMF	No product specific standard available, measurement shall be performed according to ISO 19432

121	**Swimming pool pumps**
Current	n.a.
ODELIA	See 56 Water pumps

Comments:

Odelia	Include with water pumps

122	**Air suction refuse vehicles**
Current	n.a.
ODELIA	See 7

Comments:

Odelia	Include with high pressure flushers and suction vehicles

9 Summary of proposals

In table 10 below the recommendations for all equipment types are listed, including potential new ones.

The key to the colour coding is as follows.

No change from current situation
Tighter limits
Tighter limits for some conditions
Remove from directive
New limits (Art.13 or New equipment before)
No limits (Art.12 or New equipment before)
No limits at an earlier stage but Art.12 later (New equipment before)

Table 10: Recommendations for all equipment types including potential new ones

Eq. no	Equipment name	Subgroup	Current limit	Nomeval proposal	Further comment (Nomeval)	WG7 2010	Alternative proposals	ODELIA proposal	Market sector
1	Aerial access platforms with combustion engine		Art.13	101 (P≤55 kW); 82+11*log P (P>55 kW)		104 (P≤55 kW); 85+11*log P (P>55 kW)	FEM: 104 (P≤25 kW); 108 (25 kW<P≤55); 89+11*log P (P>55 kW)	104 (P≤60 kW); 87+9.3*lg P (P>60 kW)	4 Loading and lifting equipment
2	Brush cutters		Art.13	Stage I: 105+6*P (full range) Stage II: 103+6*P (full range)	Combine with grass trimmers	Stage I: 107+6.3*P (P≤1.5 kW); Art.13 (P>1.5 kW) Stage II: 105+6.3*P (P≤1.5 kW); Art.13 (P>1.5 kW)	EGMF: 107+6.3*P (P≤1.5 kW); Art.13 (P>1.5 kW)	107+5.5*P (P≤1.5 kW); 115 (P>1.5 kW)	3 Gardening equipment
3a	Builders' hoists for the transport of goods (combustion-engine driven)	CE powered	93 (P≤15 kW); 80+11*lg P (P>15 kW)	93 (P≤15 kW); 80+11*lg P (P>15 kW)		93 (P≤15 kW); 80+11*lg P (P>15 kW)	CECE: 93 (P≤15 kW); 80+11*lg P (P>15 kW)	93 (P≤15 kW); 80+11*lg P (P>15 kW)	4 Loading and lifting equipment
3b	Builders' hoists for the transport of goods (with electric motor)	Electric	Art.13	Remove from directive	Reduced relevance	Art.13		Art.13	4 Loading and lifting equipment
4	Building site band saw machine		Art.13	Remove from directive	Not relevant for noise	Art.13		Art.13	2 Construction machinery
5	Building site circular saw bench		Art.13	110 (full range)		Art.13		111 (full range)	2 Construction machinery
6a	Chain saws, portable	CE powered	Art.13	Stage I: 110+2*P (full range) Stage II: 108+2*P (full range)	Combine with 115, 120	Stage I: 112+2*P (P≤2.5 kW); 114+2*P (P>2.5 kW) Stage II: 111+2*P (P≤2.5 kW); 113+2*P (P>2.5 kW)	EGMF: 112+2*P (P≤2.5 kW); Art.13 (P>2.5 kW)	111+2*P (full range)	3 Gardening equipment
6b		Electric	Art.13	104 (full range)		Stage I: 102+4*P (full range) Stage II: 100+4*P (full range)	EGMF: 102+4*P (full range)	100+4*P (full range)	3 Gardening equipment
7	Combined high pressure flushers and suction vehicles		Art.13	109 (full range)	Combine 7, 26 and 52 in one group	109 (full range)		108 (P≤55 kW); 89+11*lg P (P>55 kW)	1 Cleaning equipment
8a1	Compaction machines (only vibrating and non-vibrating rollers, vibratory plates and vibratory rammers)	Walk-behind vibrating rollers	108 (P≤8 kW); 109 (8 kW<P≤70 kW); 89+11*lg P (P>70 kW)	105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)		105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	CECE: 105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	2 Construction machinery
8a2		Other vibrating rollers	105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)		105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	CECE: 105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)	2 Construction machinery
8b		Non-vibrating rollers	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	2 Construction machinery
8c		Vibratory rammers	108 (P≤8 kW); 109 (8 kW<P≤70 kW); 89+11*lg P (P>70 kW)	105 (P≤8 kW); 106 (8 kW<P≤70 kW); 86+11*lg P (P>70 kW)		105 (P≤70 kW)	CECE/NB: 108 (P≤8 kW); 109 (8 kW<P≤70 kW)	107 (P≤8 kW); 108 (8 kW<P≤70 kW)	2 Construction machinery
8d		Vibratory plates	105 (P≤3 kW); 108 (3 kW<P≤8 kW); 109 (8 kW<P≤70 kW); 89+11*lg P (P>70 kW)	105 (P≤3 kW); 107 (3 kW<P≤8 kW); 108 (8 kW<P≤70 kW); 88+11*lg P (P>70 kW)	R&D feasibility for vibratory plates	105 (P≤3 kW); 107 (3 kW<P≤8 kW); 108 (8 kW<P≤70 kW); 88+11*lg P (P>70 kW)	CECE: 105 (P≤3 kW); 108 (3 kW<P≤8 kW); 109 (8 kW<P≤70 kW)	105 (P≤3 kW); 107 (3 kW<P≤8 kW); 108 (8 kW<P≤70 kW); 88+11*lg P (P>70 kW)	2 Construction machinery
8e	Compaction machines (explosion rammers only)		Art.13	Remove from directive	Only a few left on the market	Remove from directive		Remove from directive	2 Construction machinery
9	Compressors (< 350 kW)		97 (P≤15 kW); 95+2*lg P (15 kW<P<350 kW)	97 (P≤15 kW); 95+2*lg P (15 kW<P<350 kW)		97 (P≤15 kW); 95+2*lg P (15 kW<P<350 kW)		96 (P≤3 kW); 95+2*lg P (3 kW<P<350 kW)	6 Pumping and suction equipment
10a	Concrete-breakers and picks, hand-held	CE powered	105 (m≤15 kg); 94+11*lg m (m>15kg)	105 (3 kg<m≤15 kg); 92+11*lg m (15 kg<m<30 kg); 94+11*lg m (m≥30 kg)	Exclude m≤3 kg	105 (m≤15 kg); 94+11*lg m (m>15 kg)		105 (3 kg≤m≤15 kg); 92+11*lg m (15 kg<m<30 kg); 94+9.6*lg m (m≥30 kg)	2 Construction machinery
10b		Non-CE powered	105 (m≤15 kg); 92+11*lg m (15 kg<m<30 kg); 94+11*lg m (m≥30 kg)	105 (3 kg<m≤15 kg); 92+11*lg m (15 kg<m<30 kg); 94+11*lg m (m≥30 kg)	Exclude m≤3 kg	105 (m≤15 kg); 92+11*lg m (15 kg<m<30 kg); 94+11*lg m (m≥30 kg)	EPTA: Remove electrical with m<3 kg from directive	105 (3 kg<m≤15 kg); 92+11*lg m (15 kg<m<30 kg); 94+9.6*lg m (m≥30 kg)	2 Construction machinery
11	Concrete or mortar mixers		Art.13	Art. 13		Art. 13		95 (P≤2 kW); 92+11*lg P (P>2 kW)	2 Construction machinery
12a	Construction winches (combustion-engine driven)	CE powered	93 (P≤15 kW); 80+11*lg P (P>15 kW)	Remove from directive		Move to Art 13	FEM: Remove from directive	93 (P≤15 kW); 80+11*lg P (P>15 kW)	4 Loading and lifting equipment
12b	Construction winches (with electric motor)	Electric	Art.13	Remove from directive		Art. 13	FEM: Remove due to low numbers	Art.13	4 Loading and lifting equipment

Eq. no	Equipment name	Subgroup	Current limit	Nomeval proposal	Further comment (Nomeval)	WG7 2010	Alternative proposals	ODELIA proposal	Market sector
13	Conveying and spraying machines for concrete and mortar		Art.13	Art. 13	R&D on test code + limits	Art. 13	CECE/2015: Art. 13	93+11*lg P (full range)	2 Construction machinery
14	Conveyor belts		Art.13	Remove from directive	Not relevant for noise	Art 13	FEM: refine classification	Art 13 or combine with truck mixers	4 Loading and lifting equipment
15	Cooling equipment on vehicles		Art.13	Stage I: 96+2*lg P (full range) Stage II: 90+2*lg P (full range)	Stringent local requirements	Stage I: 96+2*lg P (full range) Stage II: 90+2*lg P (full range)		CE powered: 104+2*lg P (full range); Other: 90+2*lg P (full range)	5 Power generators and cooling equipment
16a	Dozers (< 500 kW)	Wheeled	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	2 Construction machinery
16b		Rubber tracked	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)		103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	CECE: 103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	2 Construction machinery
16c		Steel tracked	106 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	106 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	R&D on track noise reduction	106 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	CECE: 106 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	106 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	2 Construction machinery
17	Drill rigs	Percussive	Art.13	99 (P≤55 kW); 86+11*lg P (P>55 kW)		Stage I: 92+10*lg P (full range) Stage II: 99 (P≤55 kW); 86+11*lg P (P>55 kW)	CECE (suggests subtypes percussive/non-percussive): Art. 13	Percussive: 128 (full range); Non-percussive: 107 (P≤30 kW); 92+10*lg P (P>30 kW)	2 Construction machinery
18	Dumpers (< 500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	2 Construction machinery
19	Equipment for loading and unloading silos or tanks on trucks		Art.13	Art. 13	Change test code	Art 13		Art.13	6 Pumping and suction equipment
20	Excavators, hydraulic or rope-operated (< 500 kW)		93 (P≤15 kW); 80+11*lg P (15 kW<P<500 kW)	93 (P≤15 kW); 80+11*lg P (15 kW<P<500 kW)		93 (P≤15 kW); 80+11*lg P (15 kW<P<500 kW)	CECE: 93 (P≤55 kW); 80+11*lg P (55 kW<P<500 kW)	93 (P≤15 kW); 80+11*lg P (15 kW<P<500 kW)	2 Construction machinery
21a	Excavator-loaders (< 500 kW)	Wheeled	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	2 Construction machinery
21b		Tracked	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)		103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	CECE: 103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	2 Construction machinery
22	Glass recycling containers		Art.13	100 (full range)		Stage I: 98 (full range) Stage II: 96 (full range)		Stage I: 100 (full range); Stage II: 96 (full range)	8 Waste collection, processing and recycling
23	Graders (< 500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	2 Construction machinery
24	Grass trimmers/grass edge trimmers		Art.13	Stage I: 105+6*P (full range) Stage II: 103+6*P (full range)	Combine with grass trimmers	Stage I: 107+6.3*P (P≤1.5 kW); Art.13 (P>1.5 kW) Stage II: 105+6.3*P (P≤1.5 kW); Art.13 (P>1.5 kW)	EGMF: 107+6.3*P (P≤1.5 kW); Art.13 (P>1.5 kW)	107+5.5*P (P≤1.5 kW); 115 (P>1.5 kW)	3 Gardening equipment
25a	Hedge trimmers	CE powered	Art.13	109 (full range)		Stage I: 110 (full range) Stage II: 108 (full range)	Art. 13	108 (full range)	3 Gardening equipment
25b		Electric	Art.13	Art. 13		Stage I: 100 (full range) Stage II: 99 (full range)	Art. 13	100 (full range)	3 Gardening equipment
26	High pressure flushers		Art.13	109 (full range)	Combine 7, 26 and 52 in one group	109 (full range)		108 (P≤55 kW); 89+11*lg P (P>55 kW)	1 Cleaning equipment
27	High pressure water jet machines		Art.13	95 (P≤3 kW); Art.13 (P>3 kW)		95 (P≤3 kW); Art.13 (P>3 kW)	EGMF: Art. 13	Art 13	1 Cleaning equipment
28	Hydraulic hammers		Art.13	Stage I: 93+10*log m (full range) Stage II: 90+10*log m (full range)		Stage I: 120+3*log m (full range) Stage II: 117+3*log m (full range)	CECE (CECE/2015 new up to date data required): Stage I: 116+10*log P (full range) Stage II: 113+10*log P (full range)	Stage I: 120+3*lg m (full range); Stage II: 117+3*lg m (full range)	2 Construction machinery

Eq. no	Equipment name	Subgroup	Current limit	Nomeval proposal	Further comment (Nomeval)	WG7 2010	Alternative proposals	ODELIA proposal	Market sector
29	Hydraulic power packs		101 (P≤55 kW); 82+11*lg P (P>55 kW)	99 (P≤40 kW); 82+11*lg P (P>40 kW)	Reduce baseline	101 (P≤55 kW); 82+11*lg P (P>55 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (P>55 kW)	101 (P≤55 kW); 82+11*lg P (P>55 kW)	5 Power generators and cooling equipment
30	Joint cutters		Art.13	111 (full range)		Art 13		111 (full range)	2 Construction machinery
31	Landfill compactors, loader-type with bucket (< 500 kW)		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	Remove from directive		101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	8 Waste collection, processing and recycling
32	Lawnmowers (excluding agricultural and forestry equipment, …)		96 (L≤50 cm); 98 (50 cm<L≤70 cm); 100 (70 cm<L≤120 cm); 105 (L>120 cm)	71+15*lg L (L≤120 cm); 73+15*lg L (L>120 cm)	Include attached mowers	96 (L≤50 cm); 98 (50 cm<L≤70 cm); 100 (70 cm<L≤120 cm);105 (L>120 cm)	EGMF: 96 (L≤50 cm); 98 (50 cm<L≤70 cm); 100 (70 cm<L≤120 cm);105 (L>120 cm)	77+12*lg L (L≤120 cm); 73+15*lg L (L>120 cm)	3 Gardening equipment
33	Lawn trimmers/lawn edge trimmers		96 (L≤50 cm); 98 (50 cm<L≤70 cm); 100 (70 cm<L≤120 cm); 105 (L>120 cm)	91 (L≤50 cm)		95 (L< 30 cm); 96 (L≥ 30 cm)	EGMF: 96 (L≤50 cm)	95 (L≤50 cm)	3 Gardening equipment
34a	Leaf blowers	CE powered	Art.13	104 (full range)	Combine with leaf collectors	Stage I: 108 (P≤1.5 kW); 111 (P>1.5 kW) Stage II: 106 (P≤1.5 kW); 109 (P>1.5 kW)	EGMF: 108 (P≤1.5 kW); Art.13 (P>1.5 kW)	106 (P≤1.5 kW); 109 (P>1.5 kW)	3 Gardening equipment
34b		Electric	Art.13	99 (full range)		107 (full range)	107 (full range)	105 (full range)	3 Gardening equipment
35a	Leaf collectors	CE powered	Art.13	104 (full range)	Combine with leaf blowers	Stage I: 108 (P≤1.5 kW); 111 (P>1.5 kW) Stage II: 106 (P≤1.5 kW); 109 (P>1.5 kW)	EGMF: 108 (P≤1.5 kW); Art.13 (P>1.5 kW)	106 (P≤1.5 kW); 109 (P>1.5 kW)	3 Gardening equipment
35b		Electric	Art.13	99 (full range)		107 (full range)	107 (full range)	105 (full range)	3 Gardening equipment
36a	Lift trucks, CE driven, counterbalanced (excluding 'other counterbalanced…)		104 (P≤55 kW); 85+11*lg P (P>55 kW)	101 (P≤55 kW); 82+11*lg P (P>55 kW)		101 (P≤55 kW); 82+11*lg P (P>55 kW)	FEM: 104 (P≤55 kW); 85+11*lg P (P>55 kW)	102 (P≤55 kW); 83+11*lg P (P>55 kW)	4 Loading and lifting equipment
36b	Lift trucks, CE driven, couterbalanced (others excl. Container handling)		Art.13	101 (P≤55 kW); 82+11*log P (P>55 kW)		Art.13	FEM: Art.13	102(P≤55 kW); 83+11*lg P (P>55 kW)	4 Loading and lifting equipment
37a	Loaders (< 500 kW)	Wheeled	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	1 group for all equipment with moving and lifting function proposed including loaders, fork lifts, telescopic handlers, straddle carriers, reach stackers, container handler. Same limit for all.	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	CECE: 101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	101 (P≤55 kW); 82+11*lg P (55 kW<P<500 kW)	4 Loading and lifting equipment
37b		Rubber tracked	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)		103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	CECE: 103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 84+11*lg P (55 kW<P<500 kW)	4 Loading and lifting equipment
37c		Steel tracked	103 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)		103 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	CECE: 103 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	103 (P≤55 kW); 87+11*lg P (55 kW<P<500 kW)	4 Loading and lifting equipment
38	Mobile cranes		101 (P≤55 kW); 82+11*lg P (P>55 kW)	101 (P≤55 kW); 82+11*lg P (P>55 kW)		101 (P≤55 kW); 82+11*lg P (P>55 kW)	FEM: 101 (P≤55 kW); 82+11*lg P (P>55 kW)	100 (P≤55 kW); 81.5+11*lg P (P>55 kW)	4 Loading and lifting equipment
39	Mobile waste containers		Art.13	Stage I: 100 (full range) Stage II: 95 (full range)	Improve test code	Stage I: 100 (full range) Stage II: 95 (full range)		Stage I: 100 (full range); Stage II: 95 (full range)	8 Waste collection, processing and recycling
40	Motor hoes (< 3 kW)		93 (P<3 kW)	Remove from directive	Not relevant for noise	93 (P<3 kW)	CECE: 93 (P<3 kW)	93 (P<3 kW)	3 Gardening equipment
41a	Paver-finishers (equipped with a high-compaction screed)		Art.13	Art. 13		Art. 13		Art.13	2 Construction machinery
41b1	Paver-finishers (excluding paver-finishers equipped with a high-compaction screed)	Without a compacting screed	101 (P≤55 kW); 82+11*lg P (P>55 kW)	101 (P≤55 kW); 82+11*lg P (P>55 kW)		101 (P≤55 kW); 82+11*lg P (P>55 kW)	CECE/2015 (Pre-compacting screed): 101 (P≤55 kW); 82+11*lg P (P>55 kW)	101 (P≤55 kW); 82+11*lg P (P>55 kW)	2 Construction machinery
41b2		With a compacting screed	104 (P≤55 kW); 85+11*lg P (P>55 kW)	104 (P≤55 kW); 85+11*lg P (P>55 kW)		104 (P≤55 kW); 85+11*lg P (P>55 kW)	CECE/2015 (Compacting screed): 104 (P≤55 kW); 85+11*lg P (P>55 kW)	104 (P≤55 kW); 85+11*lg P (P>55 kW)	2 Construction machinery
42a	Piling equipment	Percussive	Art.13	Art. 13	R&D: 100+11*lg E; 95+11*lg E (E=strike energy)	Art 13	CECE/2015: Art. 13	132 (full range)	2 Construction machinery
42b		Vibrating + Static	Art.13	Stage I: 115 (full range) Stage II: 112 (full range)		Art 13	CECE/2015: Art. 13	115 (full range)	2 Construction machinery
43	Pipelayers		Art.13	Remove from directive		Art 13		Art.13	4 Loading and lifting equipment

Eq. no	Equipment name	Subgroup	Current limit	Nomeval proposal	Further comment (Nomeval)	WG7 2010	Alternative proposals	ODELIA proposal	Market sector
44	Piste caterpillars		Art.13	Remove from directive		Art 13, name Snow groomers		Art.13	7 Snowmobiles and snow groomers
45a	Power generators (< 400 kW)		95+lg Pel (Pel≤2 kW); 96+lg Pel (2 kW<Pel≤10 kW); 95+lg Pel (10 kW< Pel<400 kW)	90 (Pel≤2 kW); 93 (2 kW<Pel≤10 kW); 93+2*lg Pel (10 kW< Pel<400 kW)	Combine with welding generators in one group. New formula.	Stage I: 93+lg Pel (Pel≤2 kW); 96+lg Pel (2 kW<Pel≤10 kW); 95+lg Pel (10 kW< Pel<400 kW) Stage II: 90 (Pel≤2 kW); 94+lg Pel (2 kW<Pel≤10 kW); 93+2*lg Pel (10 kW< Pel<400 kW)		94+lg Pel (Pel≤2 kW); 95+lg Pel (2 kW<Pel≤10 kW); 94+lg Pel (10 kW< Pel<400 kW)	5 Power generators and cooling equipment
45b	Power generators (≥ 400kW)		Art.13	93+2*log Pel (Pel≥400 kW)		Stage I: 75+11*log Pel (Pel≥400 kW) Stage II: 93+2*log Pel (Pel≥400 kW)		75+11*lg Pel (Pel≥400 kW)	5 Power generators and cooling equipment
46	Power sweepers		Art.13	100 (P≤10 kW); 90+11*log P (P>10 kW)		100 (P≤8 kW); 90+11*log P (P>8 kW)	EGMF: 100 (P≤8 kW); 90+11*log P (P>8 kW) EUnited: 100 (P≤10 kW); 90+11*log P (P>10 kW)	96 (P≤5 kW); 89+11*lg P (P>5 kW)	8 Waste collection, processing and recycling
47	Refuse collection vehicles		Art.13	Stage I: 107 (full range) Stage II: 104 (full range)		Art 13 (due to test code)	EUnited: Art 13 (due to test code)	105 (full range)	8 Waste collection, processing and recycling
48	Road milling machines		Art.13	105 (P≤55 kW); 86+11*log P (P>55 kW)		Stage I: 108 (milling width < 1 m); Art. 13 (milling width >1 m) Stage II: 105 (milling width < 1 m); Art. 13 (milling width >1 m)	CECE: 87+11*lg P (full range) CECE/2015: Art.13	Art.13	2 Construction machinery
49	Scarifiers		Art.13	97+2*log P (full range)		CE powered-Stage I: 99+2*log P (full range) CE powered-Stage II: 97+2*log P (full range) Electric: Art.13	EGMF: Art.13 due to short usage and low numbers	99+2*lg P (full range)	3 Gardening equipment
50	Shredders/chippers		Art.13	Inlet ≤ 200 mm - CE powered: 109 (full range) Inlet ≤ 200 mm - Electric: 99 (full range) Inlet > 200 mm: 86+11*lg P (full range)		Inlet ≤ 250 mm: Art.13 Inlet > 250 mm: Remove from directive		109 (P≤5 kW); 119 (P>5 kW)	3 Gardening equipment
51	Snow-removing machines with rotating tools (self-propelled, excl. attachments)		Art.13	Art. 13		Art 13	EUnited: Art 13	Art.13	7 Snowmobiles and snow groomers
52	Suction vehicles		Art.13	109 (full range)	Combine 7, 26 and 52 in one group	109 (full range)		108 (P≤55 kW); 89+11*lg P (P>55 kW)	6 Pumping and suction equipment
53	Tower cranes		96+lg P (full)	96+lg P (full range)		96+lg P (full range)		96+lg P (full range)	4 Loading and lifting equipment
54	Trenchers		Art.13	Remove from directive		Art 13		Art.13	2 Construction machinery
55	Truck mixers		Art.13	101 (P≤55 kW); 85+11*log P (P>55 kW)		101 (P≤30kW); 85+11*log P (P>30 kW)	CECE/2015: Art 13	109 (P≤55 kW); 90+11*lg P (P>55 kW)	2 Construction machinery
56	Water pump units (not for use under water)	CE powered	Art.13	99 (P≤35 kW); 82+11*log P (P>35 kW)		Art 13		CE powered: 109 (P≤25 kW); 94+11*lg P (P>25 kW); Electric: 99 (full range)	6 Pumping and suction equipment
57	Welding generators		95+lg Pel (Pel≤2 kW); 96+lg Pel (2 kW<Pel≤10 kW); 95+lg Pel (Pel>10 kW)	90 (Pel≤2 kW); 93 (2 kW<Pel≤10 kW); 93+2*lg Pel (Pel>10 kW)	Combine with power generators in one group. New formula.	Stage I: 93+lg Pel (Pel≤2 kW); 96+lg Pel (2 kW<Pel≤10 kW); 95+lg Pel (Pel>10 kW) Stage II: 90 (Pel≤2 kW); 94+lg Pel (2 kW<Pel≤10 kW); 93+2*lg Pel (Pel>10 kW)		94+lg Pel (Pel≤2 kW); 95+lg Pel (2 kW<Pel≤10 kW); 94+lg Pel (Pel>10 kW)	5 Power generators and cooling equipment

Eq. no	Equipment name	Subgroup	Current limit	Nomeval proposal	Further comment (Nomeval)	WG7 2010	Alternative proposals	ODELIA proposal	Market sector
100	Airco/ventilation equipment		new	Art.12 but after investigation	R&D by UBA, Germany			Not to be included	5 Power generators and cooling equipment
101	Heat pumps		new	Art.12 but after investigation				Not to be included	6 Pumping and suction equipment
102	Mobile sieve installations		new	Stage I: Art. 13 Stage II 84+11*lg P (full range)		Not to be included	CECE/2015: Not to be included	Stage I: Art.13 ; Stage II: Art.12 (Limit needs evaluation)	8 Waste collection, processing and recycling
103	Mobile waste breakers (wood, concrete)		new	Stage I: Art. 13 Stage II 84+11*lg P (full range)		Not to be included	CECE/2015: Not to be included	Stage I: Art.13 ; Stage II: Art.12 (Limit needs evaluation)	8 Waste collection, processing and recycling
104	Tractors for construction / water pumps		new	Not to be included	Add stationary noise limit at high rpm in existing regulation		CEMA: Not to be included	Not to be included	6 Pumping and suction equipment
105	Reverse movement alarm signals (all machines)		new	Not to be included	Electronic attachment			Not to be included	Other
106	Non-fixed lifting gear, own power source		new	Not to be included				Not to be included	4 Loading and lifting equipment
107	Portal cranes for harbours and terminals		new	Art. 13		Reject due to local regulation	FEM: Reject due to local regulation	Art. 13	4 Loading and lifting equipment
108	Vehicle mounted loader cranes		new	Art. 13		Reject due to local regulation		100 (P≤55 kW); 81.5+11*lg P (P>55 kW)	4 Loading and lifting equipment
109	Walk-behind road sweepers, no aspirators (motorized broom)		new	Not to be included	Too low numbers to include.	Include with sweepers		96 (P≤5 kW); 89+11*lg P (P>5 kW)	1 Cleaning equipment
110	Street washing machine		new	Not to be included	Too low numbers to include.			96 (P≤5 kW); 89+11*lg P (P>5 kW)	1 Cleaning equipment
111	Snowmobiles		new	Stage I: 107 Stage II: 105 LWA	(LWA)	Stage I: 78 Stage II: 75 (LpASmax @ 15.2m, accelerating)	ISMA: 78 (LpASmax @ 15.2m, accelerating)	78 (LpASmax @ 15.2m, accelerating)	7 Snowmobiles and snow groomers
112	Quad (off-road)		new	Not to be included				Not to be included	Other
113	Golf green edger		new	Not to be included	Due to very low impact			Not to be included	3 Gardening equipment
114	Bird scare canons/Gas guns		new	Not to be included	Due to very low impact			Not to be included	Other
115	Telescopic or pole pruner (a. CE-powered b. Electric)		new	Include with chain saws		Not to be included	EGMF: Rejects due low usage and small numbers	CE powered: 111+2*P (full range); Electric: 100+4*P (full range)	3 Gardening equipment
116	Tree stump grinder		new	Not to be included			EGMF: Not to be included due to low numbers	Not to be included	3 Gardening equipment
117	Straddle carrier		new	Include with loaders and lift trucks		Rejects due to use only in permit areas	Rejects due to use only in permit areas	102 (P≤55 kW); 83+11*lg P (P>55 kW); (P>55 kW)	4 Loading and lifting equipment
118	Reach stacker		new	Include with loaders and lift trucks		Rejects due to use only in permit areas	Rejects due to use only in permit areas	102 (P≤55 kW); 83+11*lg P (P>55 kW); (P>55 kW)	4 Loading and lifting equipment
119	Hand-held stone cut-off saw		new	Stage I: 112+2*P Stage II: 110+2*P		Not to be included	EGMF: Art.13, separate from joint cutters	112+2*P (full range)	2 Construction machinery
120	Stone chainsaw		new	Include with chain saws		Not to be included	EGMF: Keep separate due to low number and limited usage.	CE powered: 111+2*P (full range); Electric: 100+4*P (full range)	2 Construction machinery
121	Swimming pool pumps		new	Included with waterpumps		Included with waterpumps		CE powered: 109 (P≤25 kW); 94+11*lg P (P>25 kW); Electric: 99 (full range)	6 Pumping and suction equipment
122	Air suction refuse clearing vehicles		new					108 (P≤55 kW); 89+11*lg P (P>55 kW)	Other

No change from current situation
Tighter limits
Tighter limits for some conditions
Remove from directive
New limits (Art.13 or New equipment before)
No limits (Art.12 or New equipment before)
No limits at an earlier stage but Art.12 later (New equipment before)

10 Conclusions and recommendations

An assessment has been made of the outdoor equipment noise directive 2000/14/EC and its amendment 2005/88/EC in relation to

- the limit values for equipment listed in Article 12, as to whether these could be modified in the light of the latest evidence such as the development of the state of the art concerning their performance characteristics;
- equipment listed in Article 13, as to whether any, or all, of this equipment should be assigned mandatory limit values;
- new equipment types which could feasibly be included in a future Regulation, meeting the generic description of 'equipment for use outdoors' in Article 3(a) or a foreseeable adaptation of this description, for this equipment to be assigned limit values in a future Regulation and what these should be;
- identifying and proposing the test methods for the measurement of sound power levels.

Proposals have been made for each of the above points taking available reports, papers, documents and data into account from 2007 until the present.

Several criteria were applied in this assessment including

- member state requests and information,
- environmental impact,
- stakeholder information from industry, notified bodies, authorities and NGOs,
- technical progress including databases of declared values
- economic impact
- quality of the test codes.

Decision diagrams have been applied in the analysis to explain the application of criteria.

Databases
Databases of declared noise values from the European Commission, ISPRA (MARA, Italy) and NPRO (UK) were used in the analysis to investigate current performance and pass rates for the various limit proposals. Despite some lack of data or missing parameters for several equipment types, often large numbers of data samples are available, increased in numbers and content by combining the databases. Shortcomings and errors in the databases have been taken into account, partly in cooperation with EGMF.

Stakeholder input
In response to a request letter stakeholders have provided documented feedback mostly from industry associations but also from organisations representing municipalities and noise abatement societies. In addition, limit proposals and impact were discussed with industry associations during meetings in September 2015. The conclusions of this study are not always in agreement with the industry positions but many suggestions have been taken into account, especially where better data and argumentation was provided.

Limits
All the decisions to tighten existing limits or introduce limits for some types of equipment are based on the consideration that noise limits must be the main policy instrument to ensure that excessive and unnecessary noise is controlled at source, within reasonable technical and economic means. Other instruments at national level such as local regulations for noise reception levels, usage times, bans and permits should be considered complementary supporting actions. Their extent and enforcement may differ considerably between member states.

The environmental need for the reduction or the introduction of limits has been evaluated on the basis of environmental impact indicator, calculated using the same methodology used in the Nomeval study, but updated where necessary using the many inputs received from stakeholders.

Proposal of limits for equipment currently in Article 13 or outside the scope also takes into account mention of complaints by authorities and/or requests for particular types of equipment having negative effects predominantly only in some member states. In these cases, 'Severe local noise problems in one Member State' have been considered a sufficient justification for a noise limit. In some of these cases, the environmental impact indicator, based on the number of noise exposed persons across Europe, does not reflect the noise disturbance in rural areas.

The technical feasibility for the reduction or the introduction of limits has been assessed from the databases, the product data available on the internet, the information from stakeholders, the presence of quieter models on the market, taking into account known technical solutions and constraints. Where data is lacking but noise emission and environmental impact is high, limits have been proposed that will need further data collection and assessment, for example for piling machines.

The economic feasibility for the reduction or the introduction of limits has also been assessed qualitatively, taking into account the estimated pass rate of the limits, where possible, and the technical effort required to meet these limits. The expected long period until the introduction of the future limits make them also economically feasible even for those equipment types for which little progress in the noise emission has been made to date.

Several industry associations state that the future stage of engine emissions regulation (NRMM Directive) will increase engine heat rejection, and consequently increase the cooling requirements and thereby also the noise emission of many types of outdoor machinery. This should be taken into consideration when more data is available on this effect, as little data was available to date.

Test codes
The test codes have been evaluated for each equipment type, indicating where improvements or changes are necessary, in particular with reference to new or updated standards, many of which have been revised over the last 8 years. Some however still remain an obstacle due to lack of a suitable code, shortcomings or lack of measured data. CEN has provided feedback from the Technical Committees which has been included in the evaluation in this study. A general issue is the resolution of horizontal issues in the standards, such as common definitions, work cycles, process noise, uncertainty and other issues.

For machines currently in Article13 or outside the scope, the lack of a suitable test code, large uncertainty factor, presence of process noise, local regulations or large size of machines should not be obstacles to proposing noise limits if the need is established. Test codes with shortcomings should be worked on to allow timely introduction of new limits.

Equipment currently in Article 12
For equipment currently in Article 12, tighter limits have been proposed for 9 equipment types, while none have been proposed to move to Article 13. For some of the equipment types with a low environmental impact the limits have not been changed, as well as for some equipment with a medium impact if current limits have been considered already sufficient or the changes technically or economically not feasible.

Tighter limits are proposed for:
- 8. Compaction machines (Walk-behind vibrating rollers, Vibratory rammers, Vibratory plates),
- 9. Compressors,
- 10. Concrete-breakers and picks, hand-held,
- 32. Lawnmowers (excluding agricultural and forestry equipment, …),
- 33. Lawn trimmers/lawn edge trimmers,
- 36. Lift trucks, CE driven, counterbalanced (excluding 'other counterbalanced…),
- 38. Mobile cranes,
- 45. Power generators (< 400 kW),
- 57. Welding generators

Equipment currently in Article 13
For equipment currently in Article 13, limits have been proposed for 28 equipment types. Only one obsolete equipment type has been proposed for removal from the directive (explosion rammers). Other equipment types with low environmental impact have been proposed to remain in the directive in order to avoid the re-emergence of noisy products.

For 4 equipment types, different limits for electric and CE powered machines have been proposed (Chainsaws, Hedge trimmers, Leaf blowers and Leaf collectors). These proposals were supported by evidence from the databases or by the collection of a significant amount of data from company websites.

New limits are proposed for:
- 1. Aerial access platforms with combustion engine
- 2. Brush cutters
- 5. Building site circular saw bench
- 6. Chain saws, portable (CE and Electric)
- 7. Combined high pressure flushers and suction vehicles
- 11. Concrete or mortar mixers
- 13. Conveying and spraying machines for concrete and mortar
- 15. Cooling equipment on vehicles
- 17. Drill rigs (percussive)
- 22. Glass recycling containers
- 24. Grass trimmers/grass edge trimmers

- 25. Hedge trimmers (CE and Electric)
- 26. High pressure flushers
- 28. Hydraulic hammers
- 30. Joint cutters
- 34. Leaf blowers (CE and Electric)
- 35. Leaf collector (CE and Electric)
- 36b. Lift trucks, CE driven, couterbalanced (others excl. Container handling)
- 39. Mobile waste containers
- 42. Piling equipment (Percussive and Vibrating + Static)
- 45 b. Power generators (≥ 400kW)
- 46. Power sweepers
- 47. Refuse collection vehicles
- 49. Scarifiers
- 50. Shredders/chippers
- 52. Suction vehicles
- 55. Truck mixers
- 56. Water pump units (not for use under water)

New equipment types

The list of potential new equipment to add to the Directive is almost the same as in the Nomeval study, reconsidered in the light of current information. Among the 22 types, 9 have been considered out of the scope of the directive, of insufficient impact or covered by other regulation, 3 types are proposed to be put into Article 13 and 10 types into Article 12. Some are proposed to be included in existing equipment categories.

1) Move to Article 13: 3 types

- 107. Portal cranes for harbours and terminals
- 102. Mobile sieve installations and
- 103. Mobile waste breakers (wood, concrete)

2) Move to Article 12: 10 types

- 108. Vehicle mounted loader cranes (same limits as mobile cranes)
- 109. Walk-behind road sweepers, no aspirators (motorized broom, same limits as road sweeper)
- 110. Street washing machine (same limits as road sweeper)
- 111. Snowmobiles
- 115. Telescopic or pole pruner a. CE-powered b. Electric (same limits as chainsaws)
- 117. Straddle carrier and 118. Reach stacker (same limits as lift trucks)
- 119. Handheld stone cut-off saw
- 120. Stone chainsaw (same limits as chainsaws)
- 121. Swimming pool pumps (same limits as water pumps)
- 122. Air suction refuse vehicles (same limits as High pressure flushers or suction vehicles)

3) Not to include: 9 types

- 100. Airco/ ventilation equipment (other regulation)
- 101. Heat pumps (other regulation)
- 104. Tractors for construction and water pumping (other directive)
- 105. Reverse movement alarm signals (all machines) (out of scope)

- 106. Non-fixed lifting gear, own power source (too little information and low impact)
- 112. Quad (off-road) (out of scope, other directive)
- 113. Golf green edger (currently too small numbers and impact)
- 114. Bird scare canons/Gas guns (out of scope)
- 116. Tree stump grinder (currently too small numbers and impact)

Acknowledgement
The active contributions and exchange of views with all stakeholders during this study are gratefully acknowledged.

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A Links to other directives

Machinery Directive

The most important other directive in relation to noise is the Machinery Directive 2006/42/EC, on minimum machinery safety including noise. For this directive, the noise at the relevant operator position(s) has to be measured according to the appropriate standard(s). The measurement report is part of the compulsory Technical Construction File (TCF) and the noise level must be stated in the instruction manual. If the sound pressure level exceeds 80 dB(A), then also the sound power level must be measured and stated. If the peak C-weighted sound pressure level exceeds 130 dB(C), then this must also be measured and stated.

The Machinery Directive also requires that

'Machinery must be designed and constructed in such a way that risks resulting from the emission of airborne noise are reduced to the lowest level, taking account of technical progress and the availability of means of reducing noise, in particular at source. The level of noise emission may be assessed with reference to comparative emission data for similar machinery.'

The manual must also include 'instructions relating to installation and assembly for reducing noise or vibration'.

The consequences of this directive are that most manufacturers have to measure the operator noise levels and for noisier machines also the sound power level. So many companies are already dealing with the noise issue, and noise reduction, especially where high noise levels are concerned. The solutions to reduce operator noise are not always the same as to reduce environmental noise, as the operator can be protected by cabins, placed further away from the machine or shielded locally. However, measures to reduce environmental noise will often result in lower noise at operator positions.

Physical Agents Directive

The Physical Agents Directive 2003/10/EC covers the exposure of workers to noise, thereby having an indirect impact on noise requirements set by users of machinery. A consequence of this legislation is that purchasers of machinery for professional use will tend to set contractual noise requirements to minimise the noise exposure to workers. An exposure limit value of 87 dB(A) over 8 hours is set, together with upper and lower action level values of 85 and 80 dB(A) respectively.

NRMM Exhaust Emission Directives

The Exhaust Emission Directive for Non-Road Mobile Machinery 97/68/EC covers measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery. Stages 3B (in force 2007) and 4 (in force 2009) are defined in amendment 2004/26/EC. This will affect the future design of engines for outdoor equipment. The stage 3B and stage 4 requirements will lead to application of exhaust filters and other combustion

conditions which may increase cooling requirements and thereby increase noise emission.

In the 2002/88/EC Directive, also exhaust emission limits are given for spark ignition (petrol) engines for non-road mobile machinery, including small engines for handheld applications.

Vehicle Noise Regulation
EU Regulation 540/2014 on the sound level of motor vehicles and of replacement silencing systems may affect availability of carrier vehicles with reduced noise emission. It is relevant in the sense that trucks at and around construction sites often operate at high rpm, whereas the pass-by acceleration test is not at high rpm. Another issue is that the limit values for truck pass-by noise is engine related; as quieter truck engines become available, this should also have spin-off for non-road mobile machinery.

Regulation of approval of agricultural and forestry vehicles, including external noise
EU Regulation no. 167/2013 covers the approval and market surveillance of agricultural and forestry vehicles including limits for interior and exterior noise. This includes tractors, which are numerous and in fact operate both in rural areas and urban areas in construction and municipal maintenance. The measurement method is described in Delegated Regulation (EU) 2015/96. The limits for maximum sound pressure level are for accelerating pass-by, similar to the test for other road vehicles. No exterior noise limits are specified for stationary operation.

2/3/4 Wheeler Regulation including noise
Regulation 168/2013/EU on the approval and market surveillance of two- or three-wheel vehicles and quadricycles, also sets limits for the pass-by noise for these vehicles and regulates anti-tampering. Although nog directly relevant for the OND, some parallels may be observed. For small 2-wheelers, similar issues are at stake as for some handheld machinery.

Environmental Noise Directive
The Environmental noise directive 2002/49/EC (END) is relevant, in as far as outdoor machinery is taken into account in industrial noise mapping and action plans. The OND is referred to but no further links are mentioned.

Ecodesign Directive
Directive 2009/125/EC on Ecodesign requirements for energy-using products (EUP), may affect the power management of equipment and its basic design, and noise limits for those equipment types specifically selected. These are typically very numerous equipment types which have a large environmental impact.

Biofuels Directive
Biofuels Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport gives definitions of alternative fuels to diesel and petrol and aims to promote those more environmentally friendly fuels for road vehicles. This may at a later stage also be relevant for outdoor equipment and its noise emission.

REACH Directive
Directive 1907/2006/EC concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) may affect the types of materials or lubricants applied in outdoor equipment.

WEEE Directive
Directive 2002/96/EC on Waste Electrical and Electronic equipment (WEEE) may affect material choice and design of electrically powered equipment.

B Environmental impact indicator

The Environmental impact indicator also applied in the Nomeval study is summarised here. The rated sound power level averaged over a year is defined as:

$$L_{WA,ratedyearreq} = L_{WA,guaranteed} + C_{evening/night} + C_{tonal/imp} + C_{intermittent} + C_{opcon} + 10\lg\left(\frac{n_{months} n_{days} t_{dayuse}}{364 \cdot 24 \cdot 60}\right) \quad \text{(B1)}$$

where

n_{months}	number of months per year in use;
n_{days}	number of days per month in use;
t_{dayuse}	minutes per day in use;
$C_{evening/night}$	adjustment for evening/night use (0 or 5 dB)
$C_{tonal/imp}$	adjustment for tonal and/or impulsive sound character (0 or 5 dB)
$C_{intermittent}$	adjustment for sound character due to intermittent use (0, 3 or 6 dB)
C_{opcon}	adjustment for difference in operating condition between normal use and testing conditions (0 or 3 dB).

These terms are listed for each equipment type in the data sheets in appendix F. The environmental impact indicator per equipment type and situation type is defined as:

$$EI_{\text{equip,situ}} = 10\lg\left(\frac{364. \sum_{i=i\min}^{i\max} \mathrm{N}_{\text{equip,situ}} \mathrm{D}_{\text{equip,situ},i} 10^{L_i/10}}{\sum_{\substack{equip,\\situ}} (\mathrm{N}_{\text{equip,situ}} \sum_{i=i\min}^{i\max} \mathrm{D}_{\text{situ},i})}\right) \quad \text{(B2)}$$

Averaged over all situations the EI per equipment type is

$$EI_{equip} = 10\lg\left(\sum_{situ} 10^{EI_{equip,situ}/10}\right) \quad \text{(B3)}$$

where

$N_{equip,situ}$	number of equipment in specific situation, corrected for percentage usage during year (%use);
L_i	sound pressure level class *i* (5 dB classes) as obtained for a noise source with sound power level $L_{WA,ratedyearreq}$ based on database average of $L_{WA,guaranteed}$.
$D_{equip,\ situ,i}$	Distribution factor: number of inhabitants in each sound level band *i* for each equipment type (equip) and each situation (situ).
$D_{situ,i}$	Distribution factor: number of inhabitants in each sound level band *i* for all equipment types and each situation (situ).

The factor 364 and the denominator in formula B2 are for normalisation. In the Nomeval report these were implicitly included in the distribution factor $D_{equip,situ,i}$.

Results for the EI indicator are set out in figures B1 and B2 for equipment types in the current directive and for potential new types in figure B3. Average guaranteed sound power levels are set out in a similar way in figures B4 and B5.

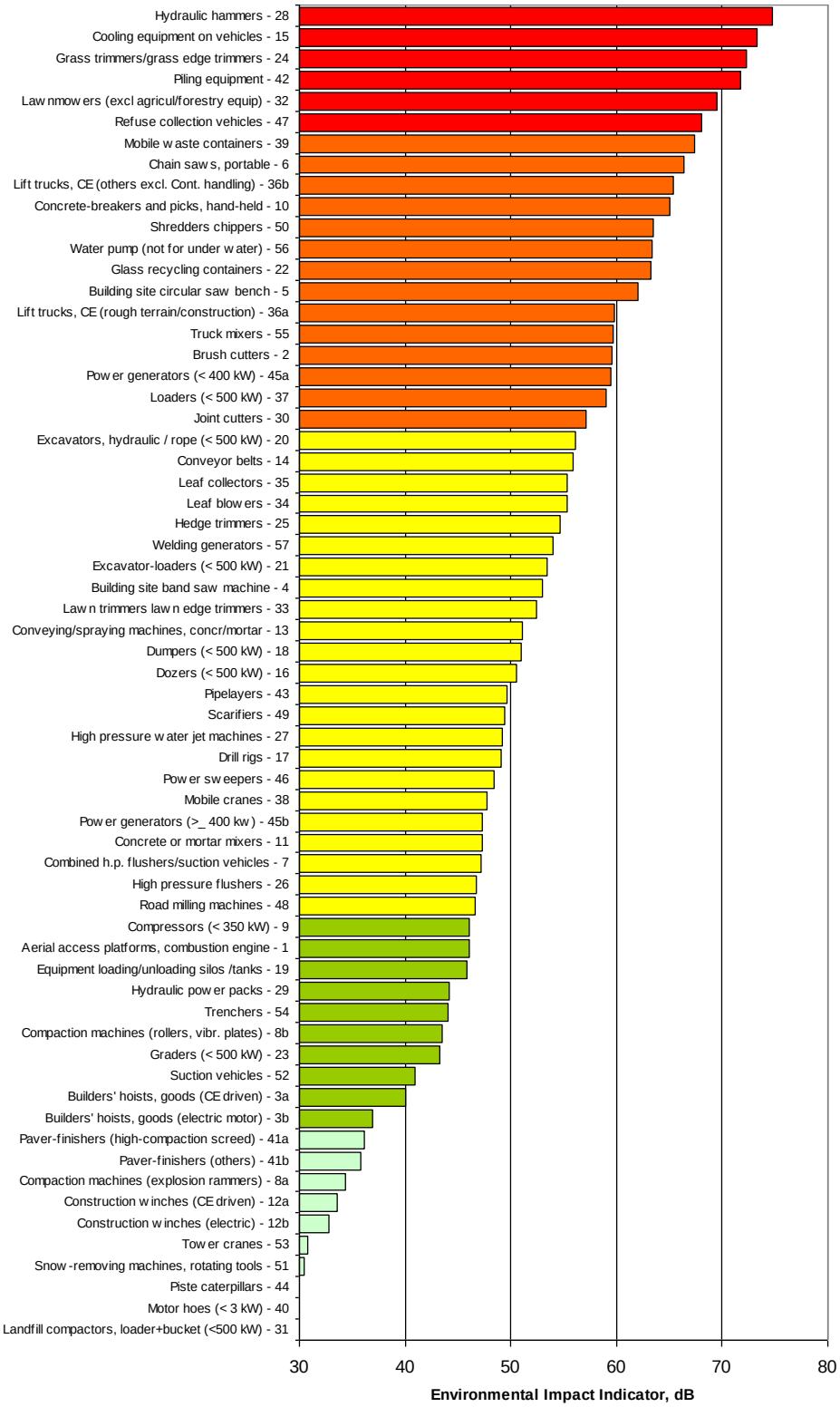


Figure B1: Environmental impact indicator level for each equipment type as determined in the Nomeval study.

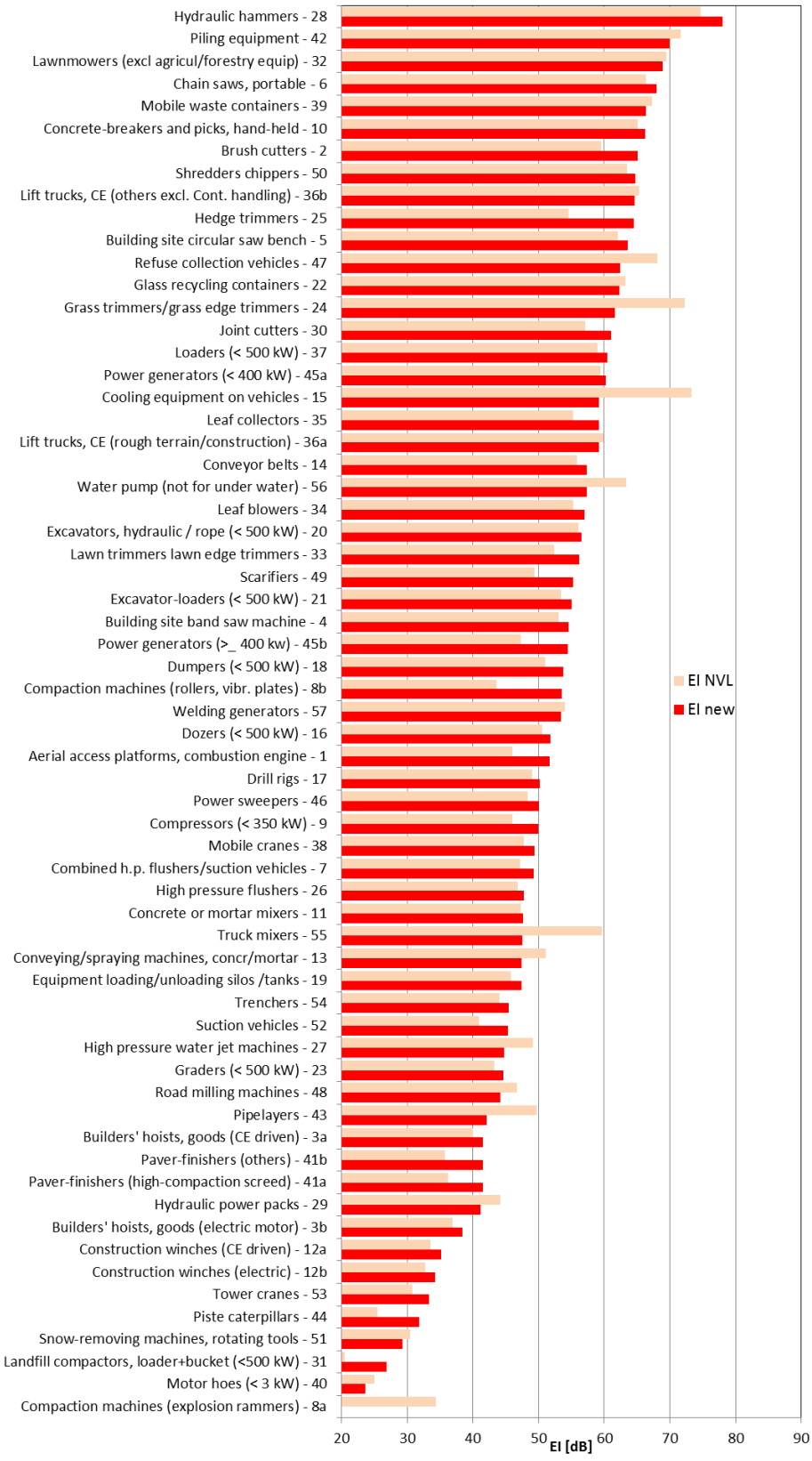


Figure B2: Environmental impact indicator level for each equipment type as determined for current input data and compared with the Nomeval results (light red).

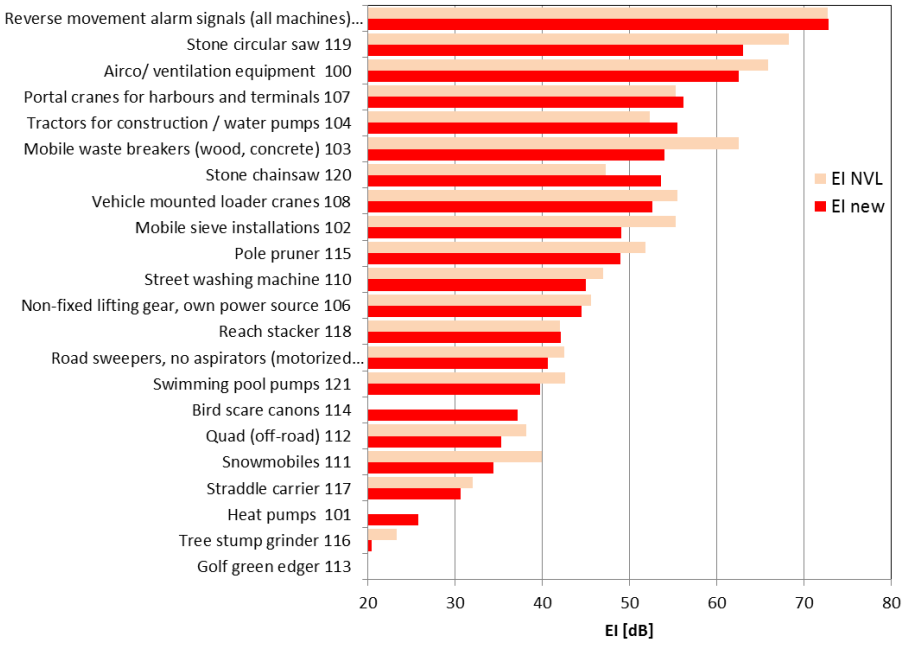


Figure B3: Environmental impact indicator level for new equipment types as for current input data and compared with the Nomeval results (light red).

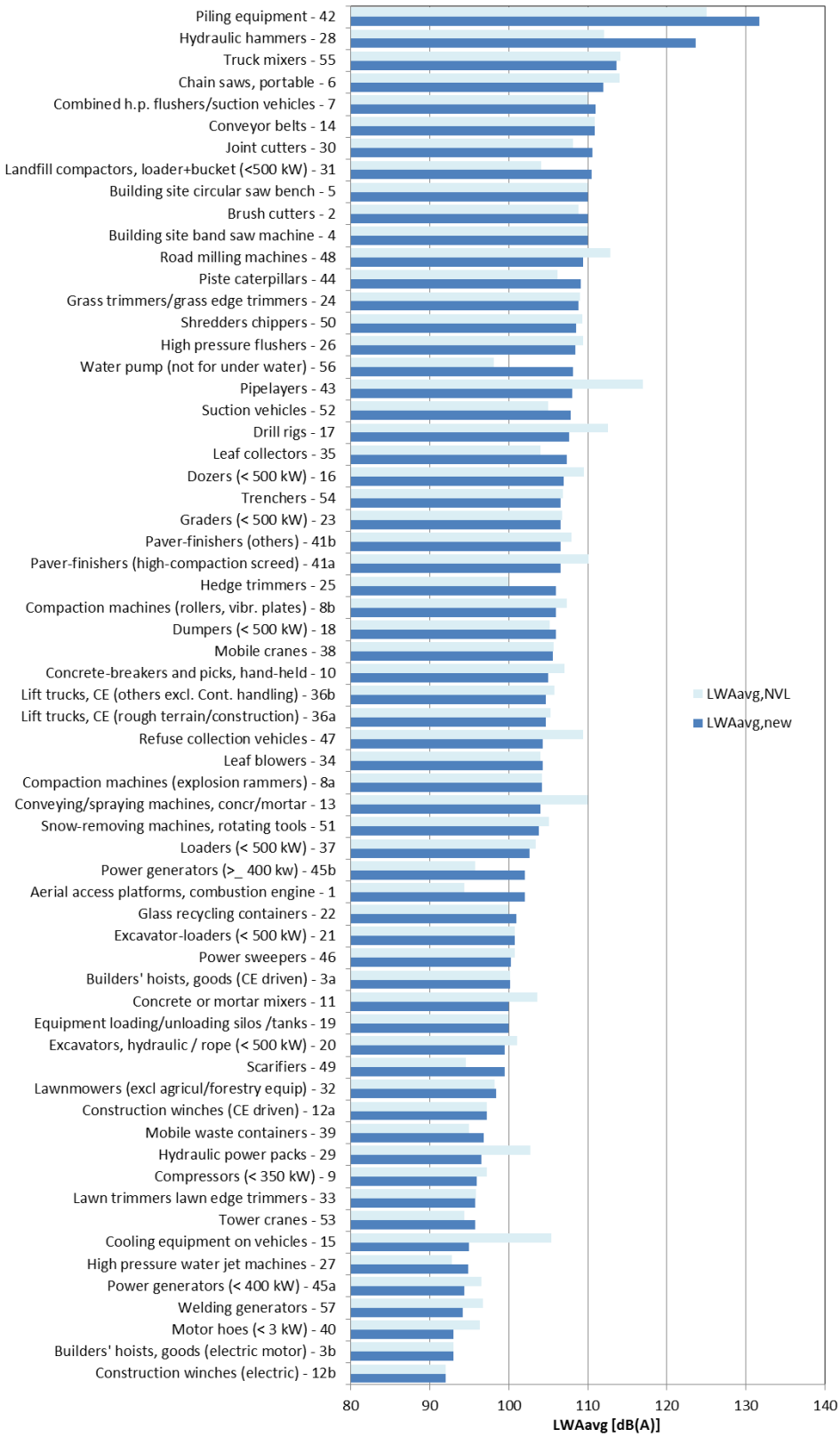


Figure B4: Average sound power level for each equipment type for current estimate and compared with Nomeval values (light blue)

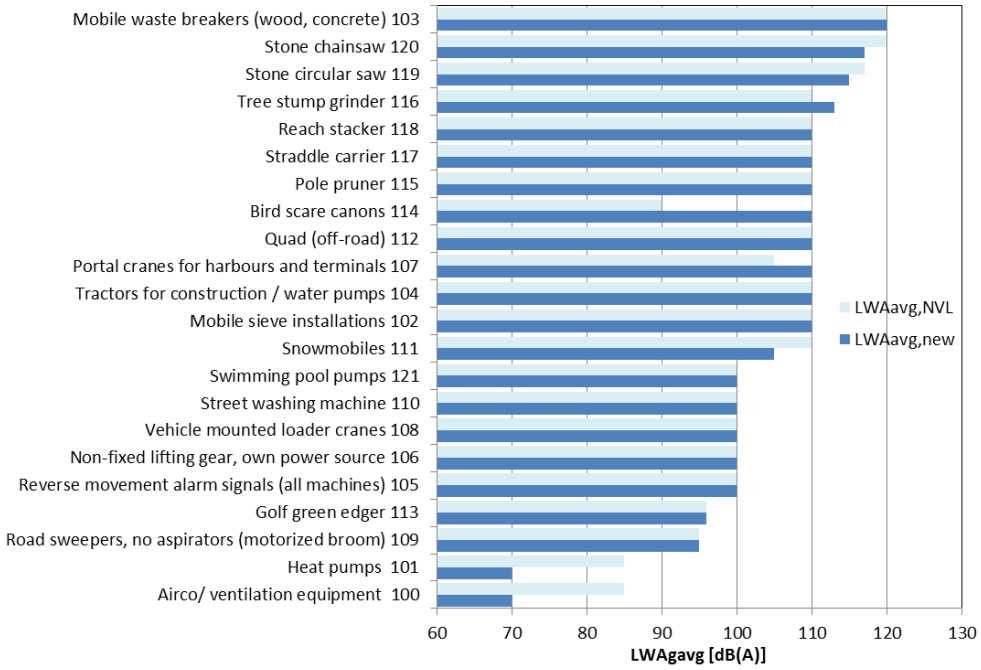


Figure B5: Average sound power level for each new equipment type for current estimate and compared with Nomeval values (light blue).

C Database analysis

Databases made available for the purpose of this study were used to assess noise emission data and potential limit curves. These include the EU Machinery noise database, the Italian MARA database, the UK NMRO database and the Dutch MIA/VAMIL database. Data from the EU database and UK database have been taken from 2007 onwards. The Dutch database is not combined with the other databases as it contains a subset of quieter machines, but it is included in Appendix E for information. A separate data anaysis of several equipment types by Notified bodies is included in Appendix D.

Data is shown for most equipment types. Some have very few entries in the databases, but are shown for information. Most have a reasonable or large amount of data when the databases are combined. Data with incorrect equipment type, zero or missing technical parameter or clearly out of range, has been omitted as far as possible.

Guaranteed sound power levels and various limit curves are set out in the top graph. On the right of the graph, the arithmetic average of the guaranteed sound power levels, of the measured levels and of the difference is listed. The average guaranteed level is used as an impact to the environmental impact analysis, although it is adjusted for factors such as work cycle and sound characteristics where appropriate. Limit curves are indicated by ODELIA for this study, NVL for Nomeval, WG7 for Working group 7, CECE, EGMF, FEM or otherwise for other stakeholder proposals.

The middle graph shows a histogram of numbers of data points in small ranges, giving the total number of records in each range, and for each limit curve the number of records meeting the limit.

The lower graph shows the pass rates for the whole range and for separate ranges of the technical parameter, for each limit curve. Only data lying within the shown plot range are included to assess the pass rates.

A dedicated tool was used to assess the databases and pass rates of the different limit proposals, This is shown in figure C1. It cuts out all data outside the data range of the graph itself.

The contents of the databases are summarised in table C1. The numbers of data points finally used in the analysis of each equipment type can be found at the top of each graph. Empty fields may exist where electrically powered equipment have been separated from data groups containing both CE and electrically powered equipment.

The EU database has been provided by the European Commission DG Growth, the Italian MARA database by ISPRA, the UK database by the National Measurement and Regulation Office, and the Dutch database by RVO, which is gratefully acknowledged.

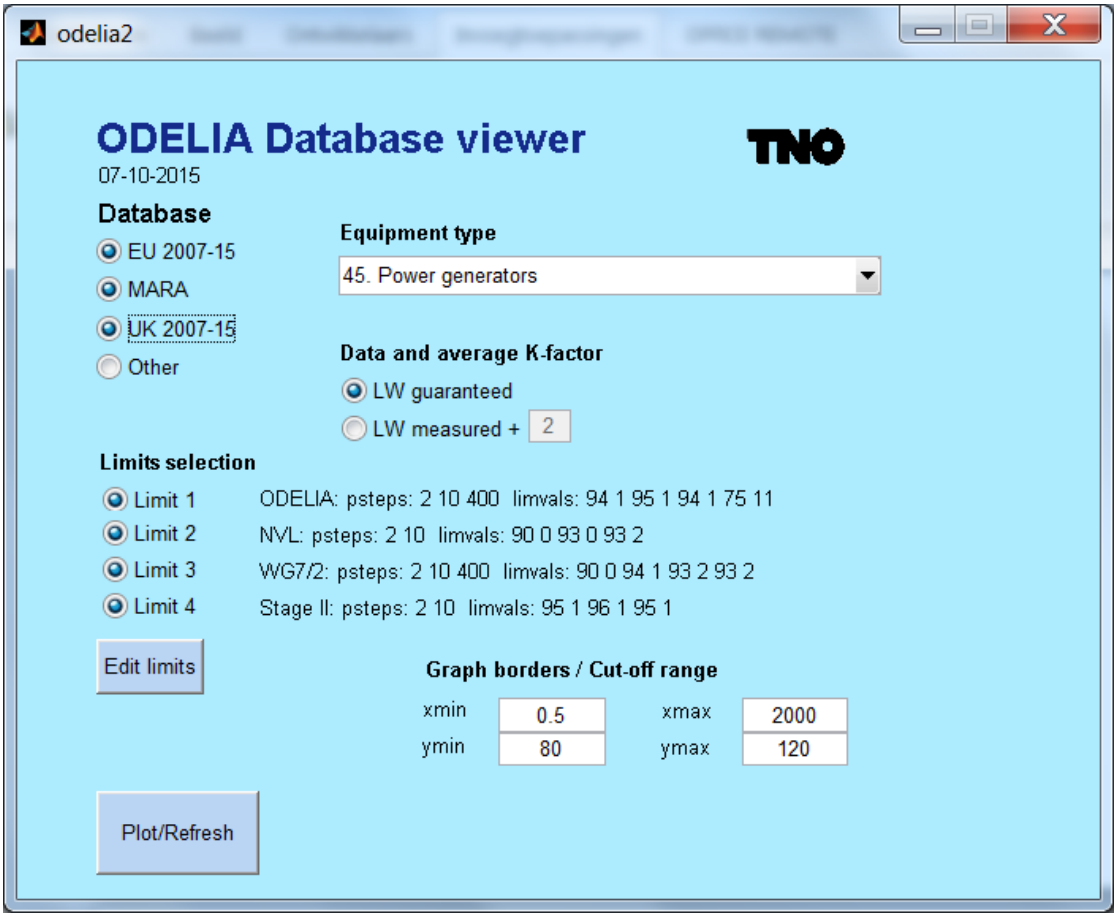
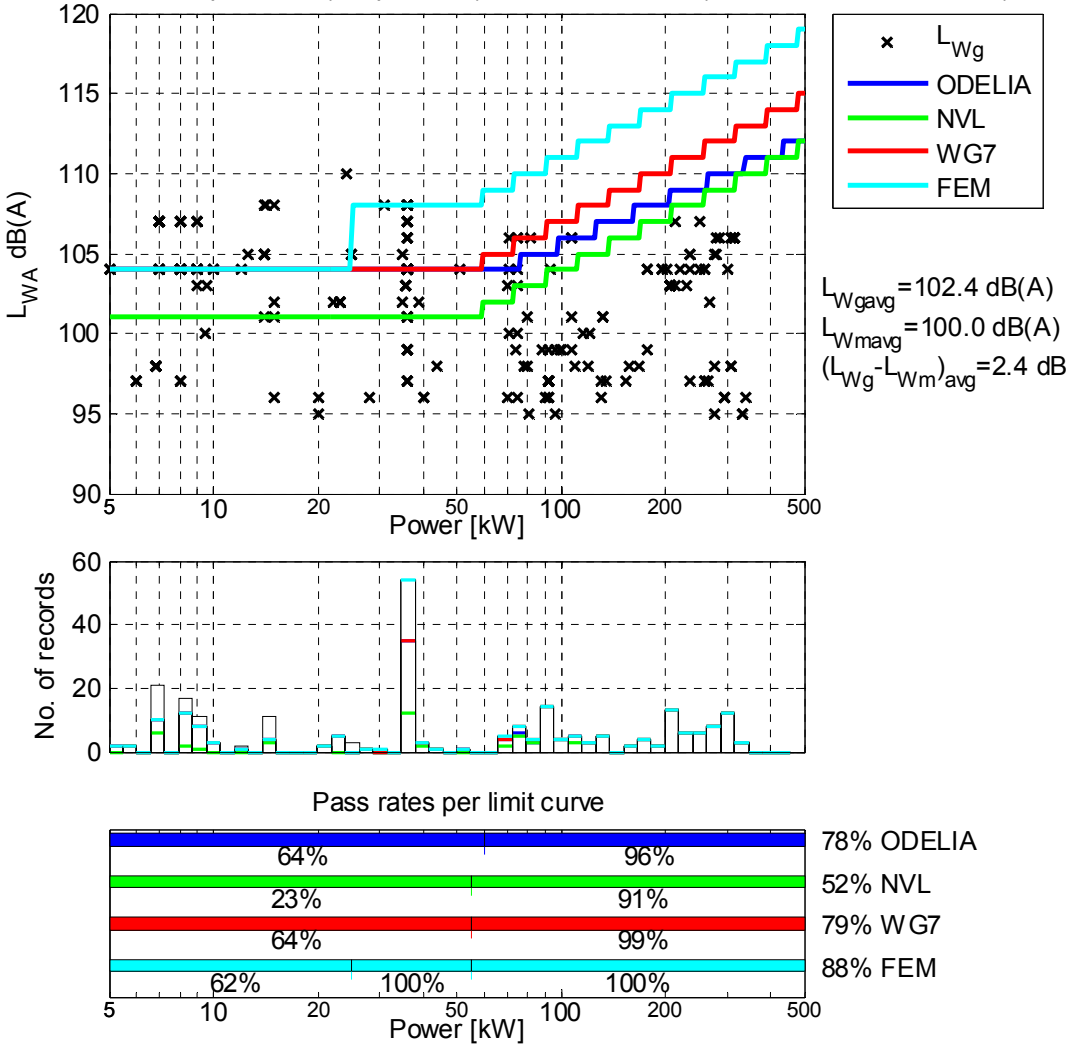


Figure C1: Database viewer tool.

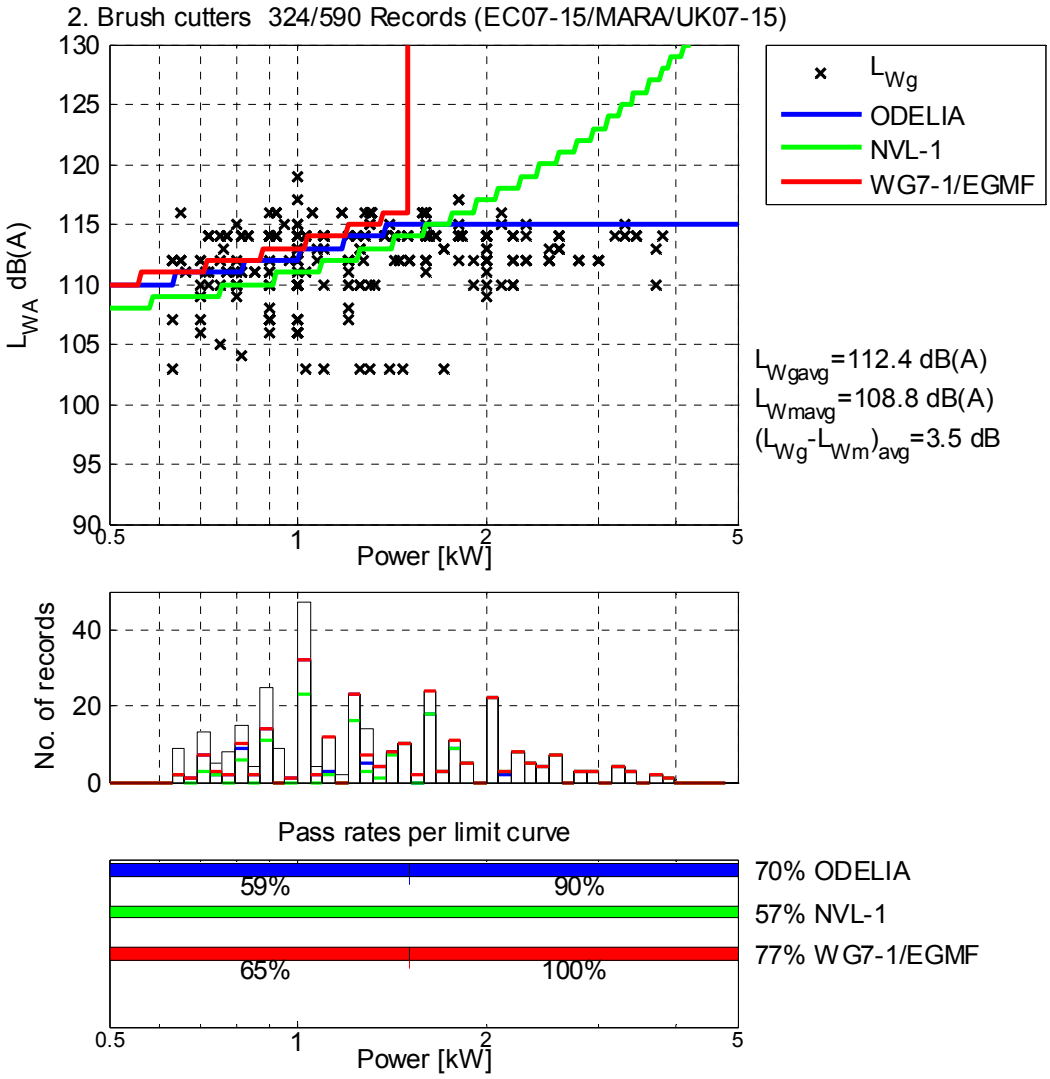
Table C1: Overview of database content

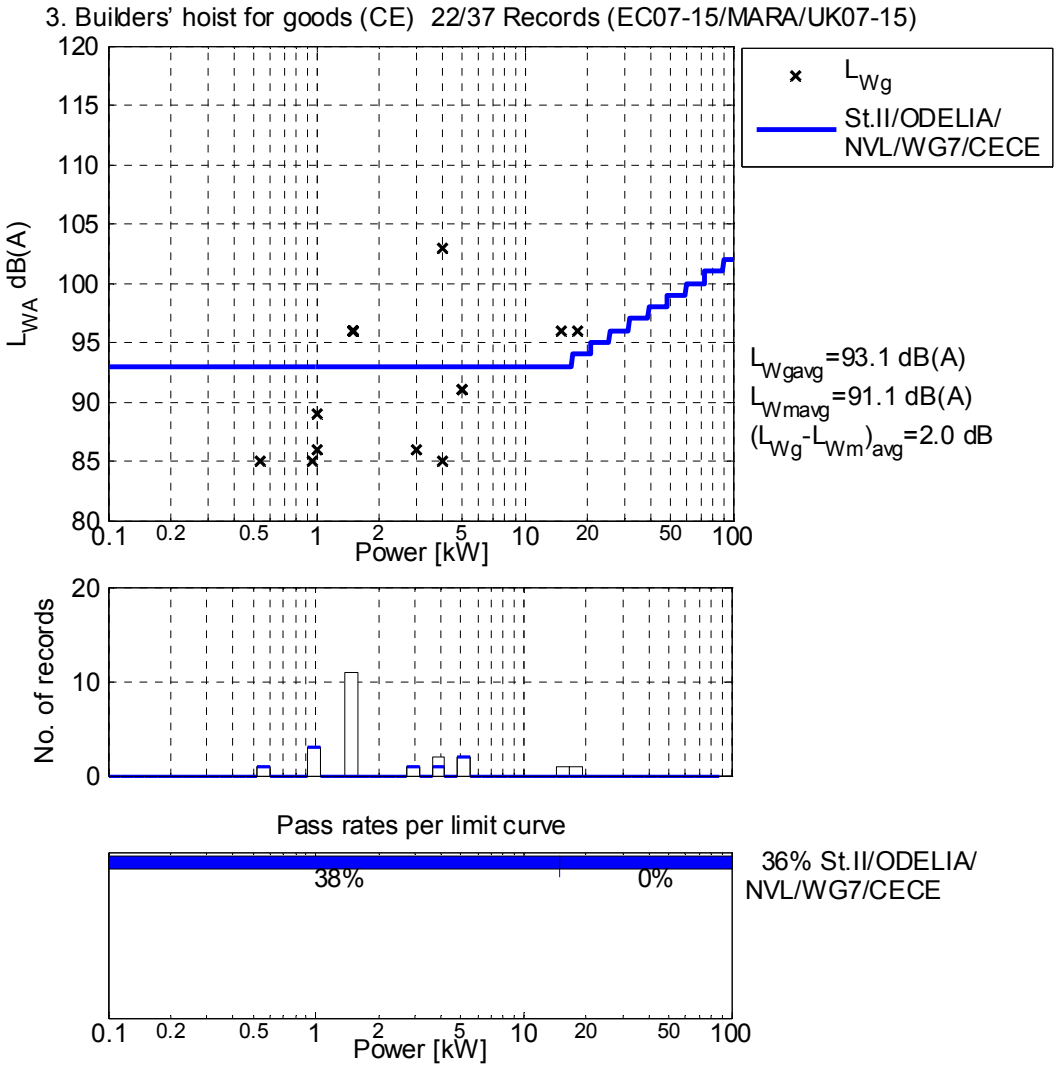
Database	EC07-15		MARA		UK		Total	
	Records	Selected	Records	Selected	Records	Selected	Records	Selected
Totals	8245	6322	5058	4291	5415	2298	18718	12911
Equipment type		77%		85%		42%		69%
1. Aerial access platforms (CE powered)	190	83	234	158	43	3	467	244
2. Brush cutters	199	134	196	153	195	37	590	324
3. Builders' hoist for the transport of goods	4	4	33	18	0	0	37	22
4. Building site band saw machine	0	0	0	0	0	0	0	0
5. Building site circular saw bench	9	7	9	9	1	0	19	16
6. Chain saws (CE)	283	124	92	38	262	60	637	222
6. Chain saws (EL)		89		5		42		136
7. Combined high pressure flushers and suction vehicles	254	116	210	210	1	0	465	326
8. Compaction machines	519	417	133	132	112	91	764	640
9. Compressors	174	152	275	262	166	62	615	476
10. Concrete breakers and picks hand-held	127	91	57	57	60	1	244	149
11. Concrete or mortar mixers	113	15	40	14	10	0	163	29
12. Construction winches (CE driven)	19	11	7	0	0	0	26	11
13. Conveying and spraying machines for concrete and mortar	46	5	68	51	3	0	117	56
14. Conveyor belts	0	0	1	1	1	0	2	1
15. Cooling equipment on vehicles	10	10	47	44	0	0	57	54
16. Dozers	68	61	1	1	0	0	69	62
17. Drill rigs (NP)	60	36	109	109	3	3	172	148
17. Drill rigs (P)	30	30	0	0	0	0	30	30
18. Dumpers (< 500 kW)	116	67	104	34	75	43	295	144
19. Equipment for loading and unloading silos or tanks on trucks	0	0	0	0	1	0	1	0
20. Excavators hydraulic or rope-operated (< 500 kW)	363	341	215	192	87	71	665	604
21. Excavator-loaders (< 500 kW)	31	30	8	8	58	52	97	90
22. Glass recycling containers	3	0	10	10	2	0	15	10
23. Graders (< 500 kW)	0	0	0	0	9	9	9	9
24. Grass trimmers	65	3	37	11	249	11	351	25
25. Hedge trimmers CE powered	137	35	30	21	308	25	475	81
25. Hedge trimmers EL powered	165	165	23	23	67	67	255	255
26. High pressure flushers	17	2	0	0	0	0	17	2
27. High pressure water jet machines	345	196	541	410	460	31	1346	637
28. Hydraulic hammers	358	280	101	71	10	0	469	351
29. Hydraulic power packs	19	13	15	15	7	7	41	35
30. Joint cutters	24	20	27	27	2	2	53	49
31. Landfill compactors	1	0	0	0	2	2	3	2
32. Lawnmowers	1919	1731	452	419	1871	983	4242	3133
33. Lawn trimmers/lawn edge trimmers	273	228	15	13	25	5	313	246
34. Leaf blowers CE	82	37	28	26	125	18	235	81
34. Leaf blowers EL		26		20		16		62
35. Leaf collectors CE	53	25	37	31	60	8	150	64
35. Leaf collectors EL		29		1		10		40
36. Lift trucks CE driven counterbalanced	243	173	336	318	26	14	605	505
37. Loaders	349	340	109	109	76	59	534	508
38. Mobile cranes	93	79	104	83	13	12	210	174
39. Mobile waste containers	39	28	0	0	25	0	64	28
40. Motor hoes	61	52	21	20	21	10	103	82
41. Paver finishers	69	66	0	0	10	0	79	66
42. Piling equipment	9	9	0	0	6	6	15	15
43. Pipelayers	6	6	0	0	0	0	6	6
44. Piste Caterpillars	0	0	7	7	0	0	7	7
45. Power generators	591	539	438	419	457	332	1486	1290
46. Power sweepers	42	30	44	43	34	14	120	87
47. Refuse collection vehicles	0	0	59	45	2	0	61	45
48. Road milling machines	29	29	2	0	0	0	31	29
49. Scarifiers	62	39	93	33	57	19	212	91
50. Shredders/chippers	111	98	140	140	86	53	337	291
51. Snow-removing machines with rotating tools	72	39	7	7	60	37	139	83
52. Suction vehicles	22	9	3	3	4	0	29	12
53. Tower cranes	44	0	78	72	0	0	122	72
54. Trenchers	11	9	8	8	18	13	37	30
55. Truck mixers	36	4	31	18	29	0	96	22
56. Water pump units (CE)	260	90	383	237	197	32	840	359
56. Water pump units (EL)		68		95		35		198
57. Welding generators	20	2	40	40	19	3	79	45

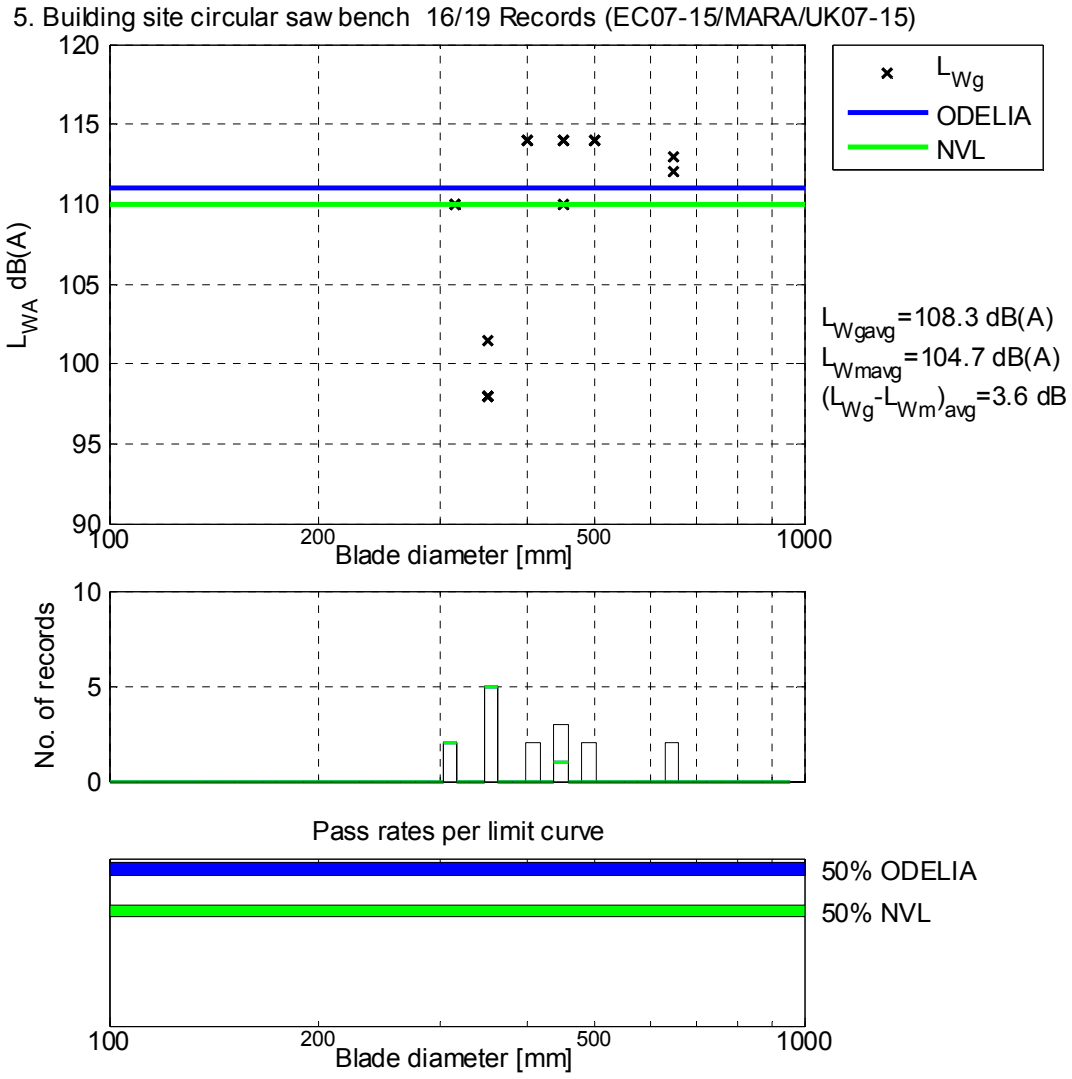
1. Aerial access platforms (CE powered) 244/467 Records (EC07-15/MARA/UK07-15)

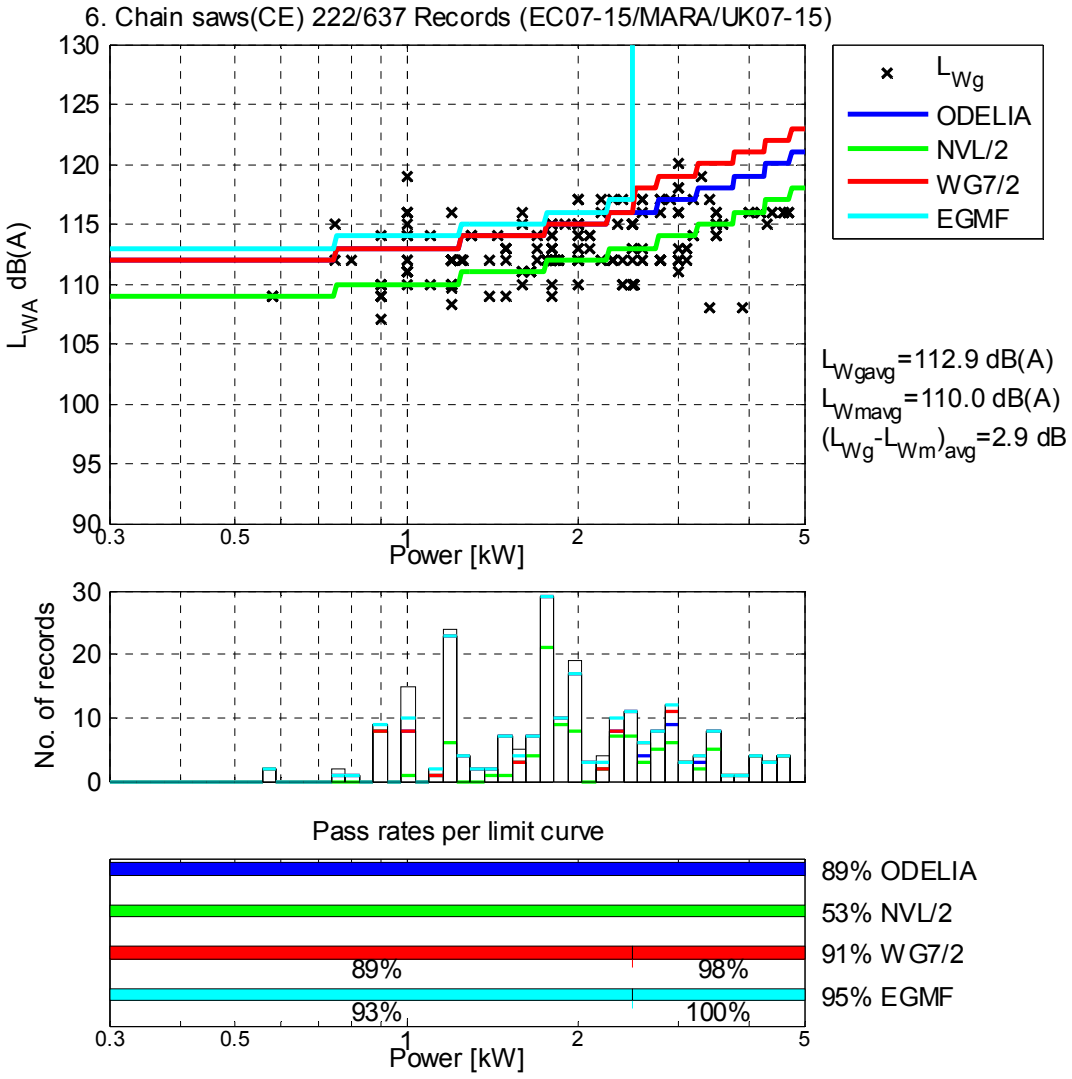


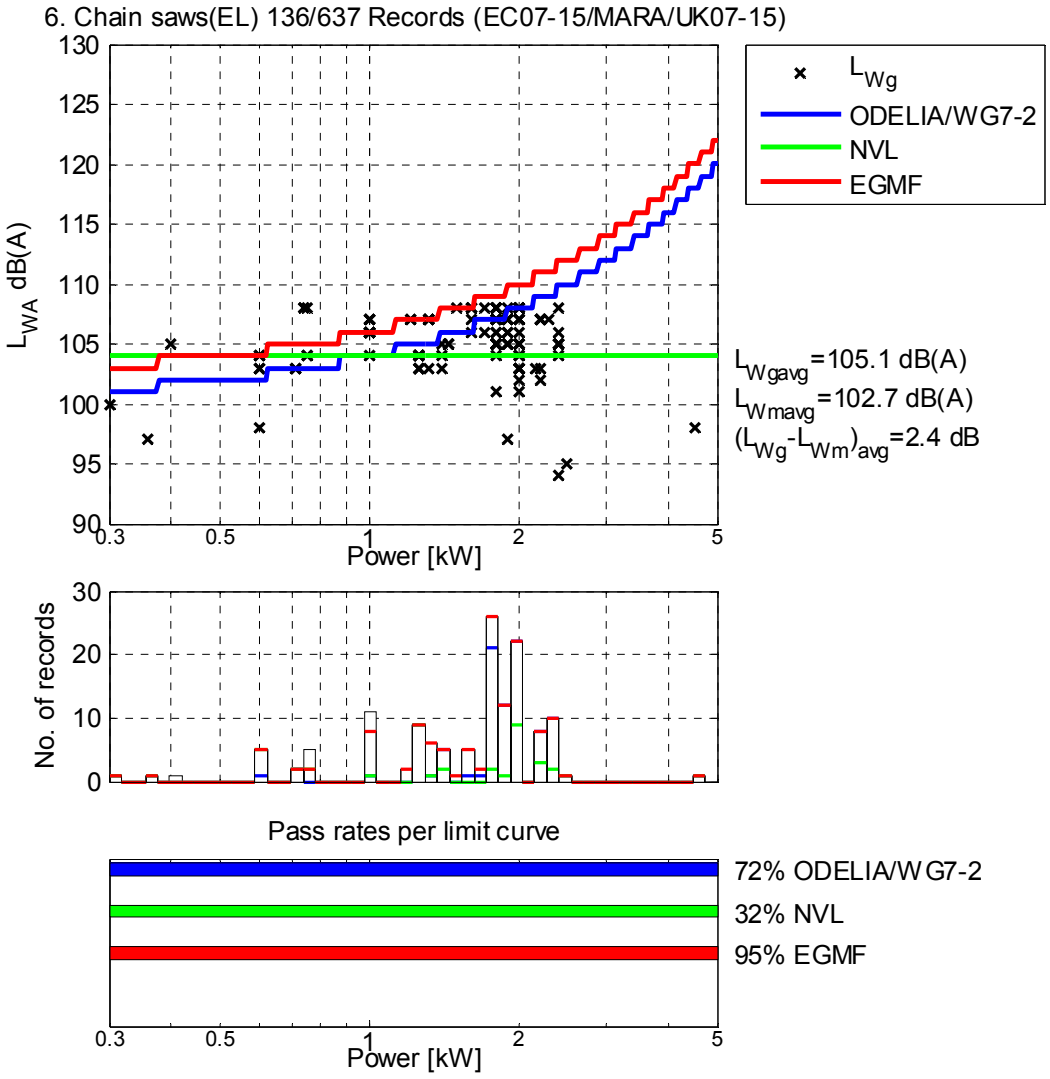
Note: Data with levels below 95 dB(A) are excluded as they are either for electrical units or represent sound pressure levels. This results in higher average guaranteed sound power level than in Nomeval, 102.4 instead of 94 dB(A).


2. Brush cutters 324/590 Records (EC07-15/MARA/UK07-15)
130
125
120
115
110
105
100
95
90
L_{WA} dB(A)
0.5
1
2
5
Power [kW]
L_{Wg}
ODELIA
NVL-1
WG7-1/EGMF
L_{Wgavg}=112.4 dB(A)
L_{Wmavg}=108.8 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.5 dB
No. of records
40
20
0
Pass rates per limit curve
59%
90%
65%
100%
70% ODELIA
57% NVL-1
77% WG7-1/EGMF
0.5
1
2
5
Power [kW]

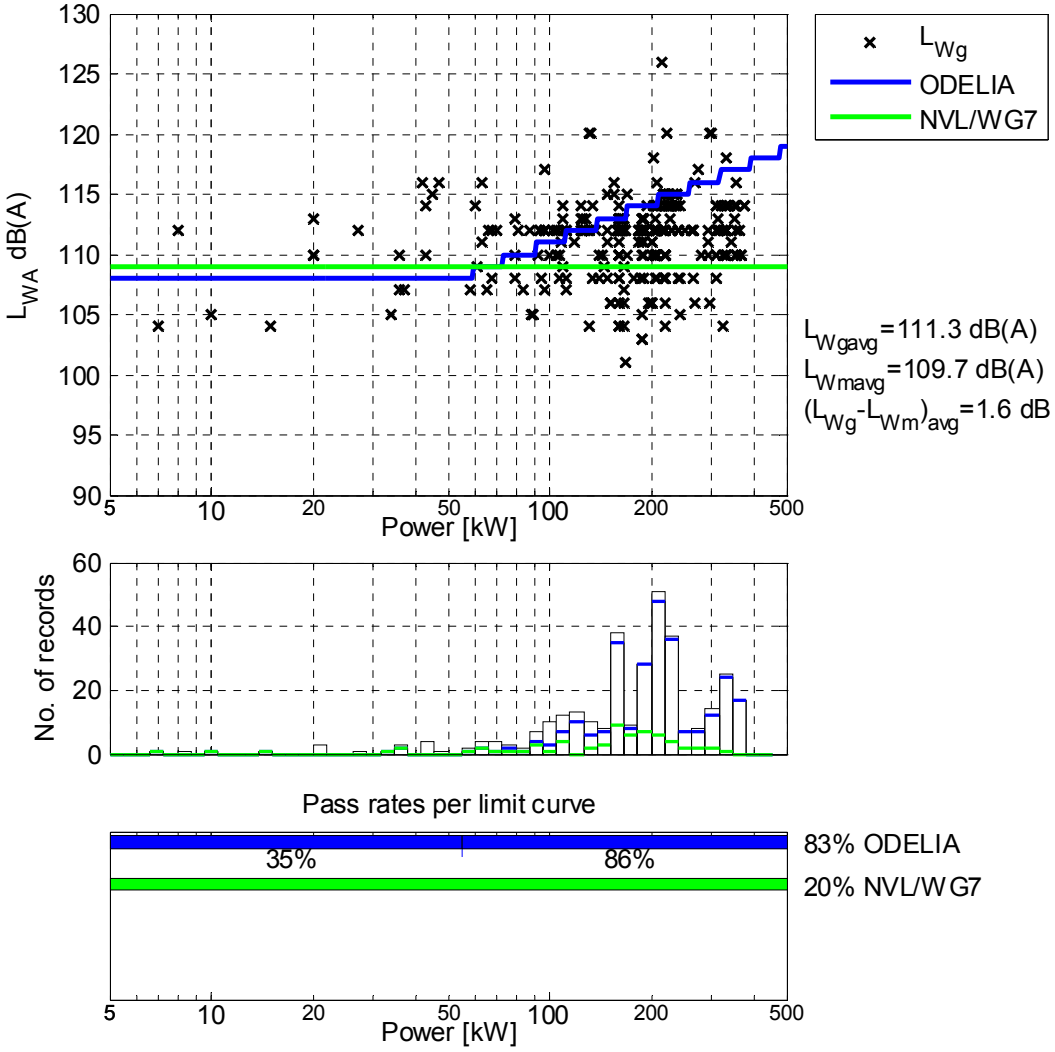

3. Builders' hoist for goods (CE) 22/37 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
St.II/ODELIA/ NVL/WG7/CECE
L_{Wgavg}=93.1 dB(A)
L_{Wmavg}=91.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.0 dB
No. of records
Pass rates per limit curve
38%
0%
36% St.II/ODELIA/ NVL/WG7/CECE


5. Building site circular saw bench 16/19 Records (EC07-15/MARA/UK07-15)
120
115
110
105
100
95
90
L_{WA} dB(A)
100
200
500
1000
Blade diameter [mm]
L_{Wg}
ODELIA
NVL
L_{Wgavg}=108.3 dB(A)
L_{Wmavg}=104.7 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.6 dB
10
5
0
No. of records
Pass rates per limit curve
50% ODELIA
50% NVL
100
200
500
1000
Blade diameter [mm]

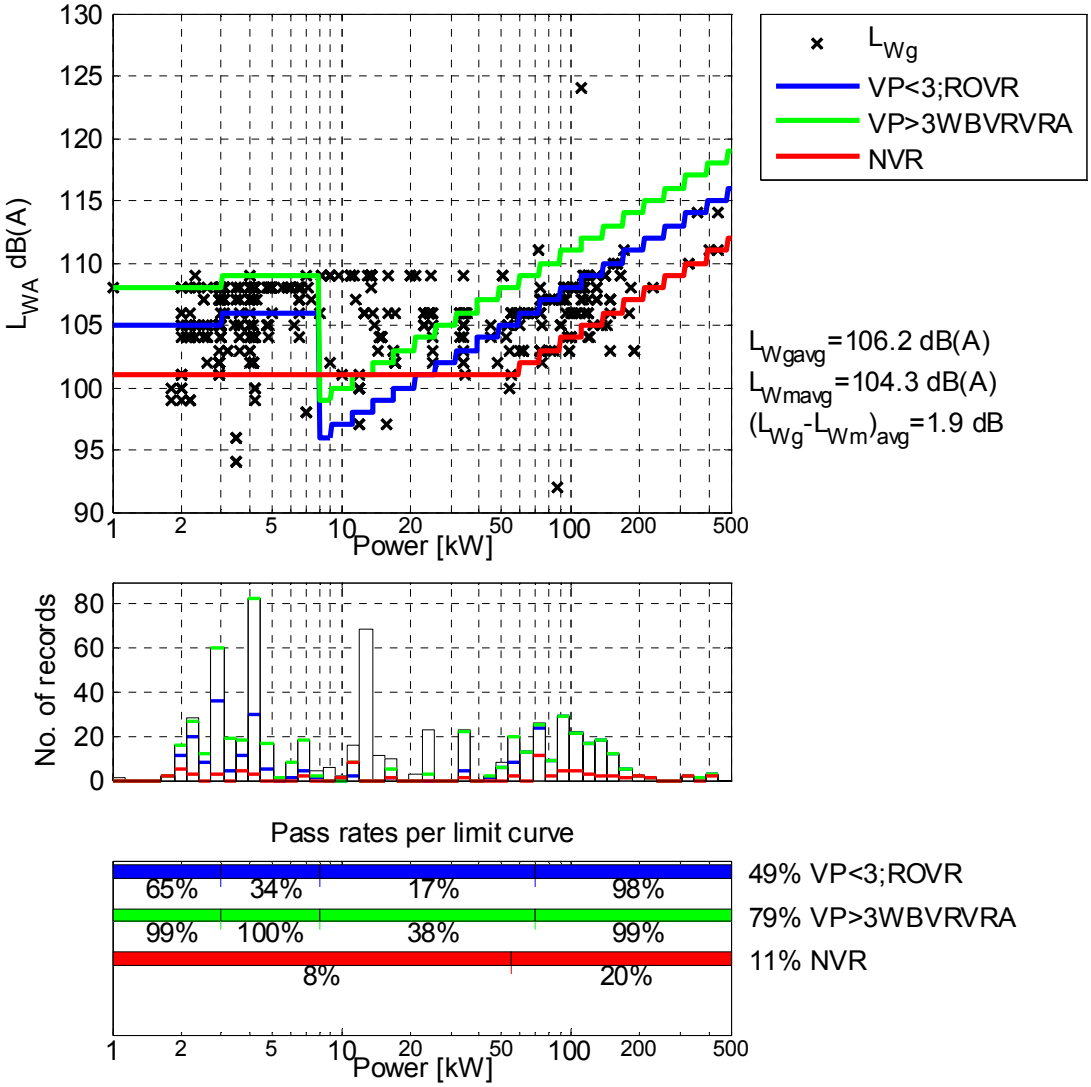

6. Chain saws(CE) 222/637 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA
NVL/2
WG7/2
EGMF
L_{Wgavg}=112.9 dB(A)
L_{Wmavg}=110.0 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.9 dB
No. of records
Pass rates per limit curve
89% ODELIA
53% NVL/2
91% WG7/2
95% EGMF
89%
98%
93%
100%


6. Chain saws(EL) 136/637 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA/WG7-2
NVL
EGMF
L_{Wgavg}=105.1 dB(A)
L_{Wmavg}=102.7 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.4 dB
No. of records
Pass rates per limit curve
72% ODELIA/WG7-2
32% NVL
95% EGMF

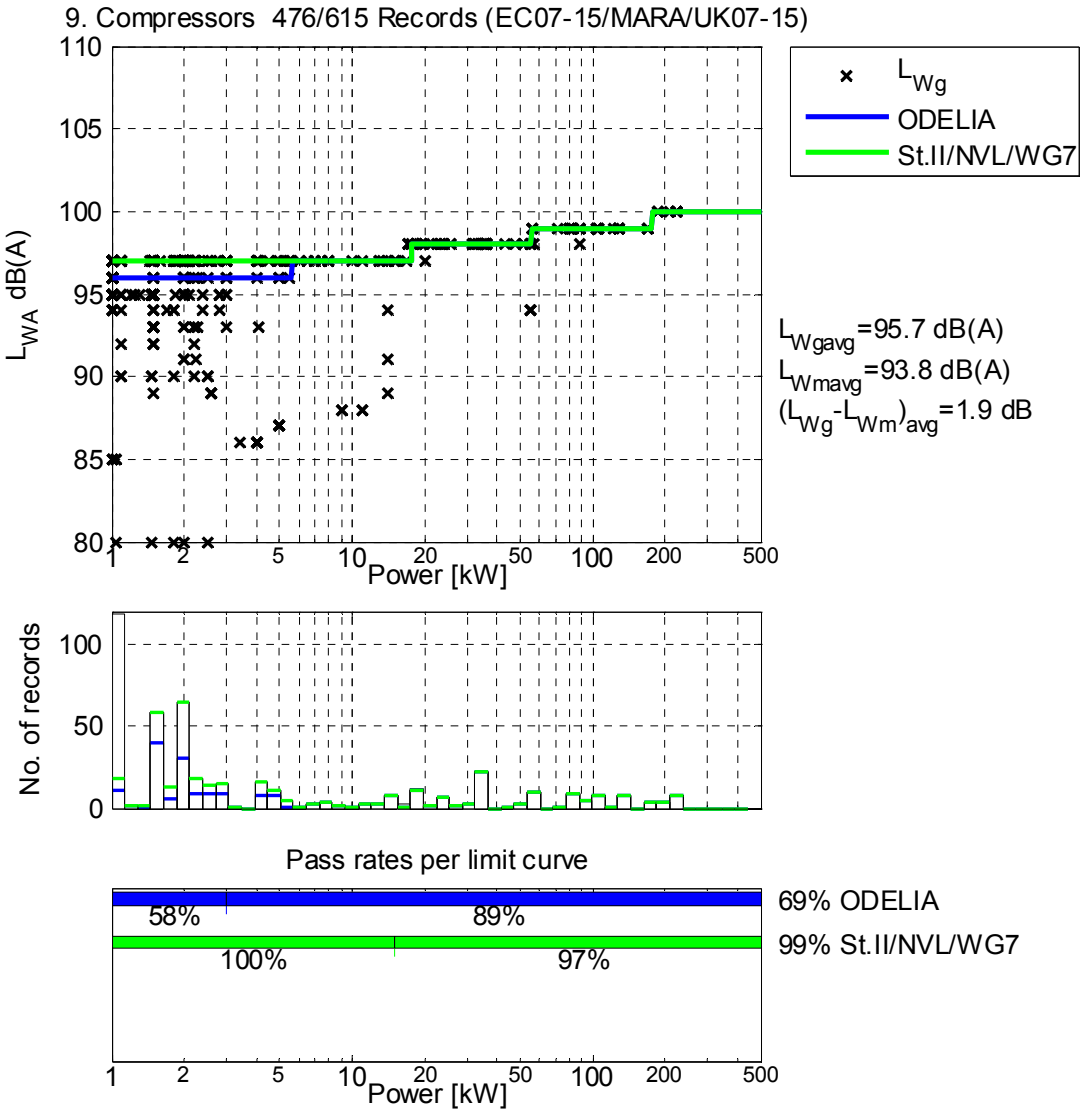
7. Combined HP flushers and suction vehicles 326/465 Records (EC07-15/MARA)



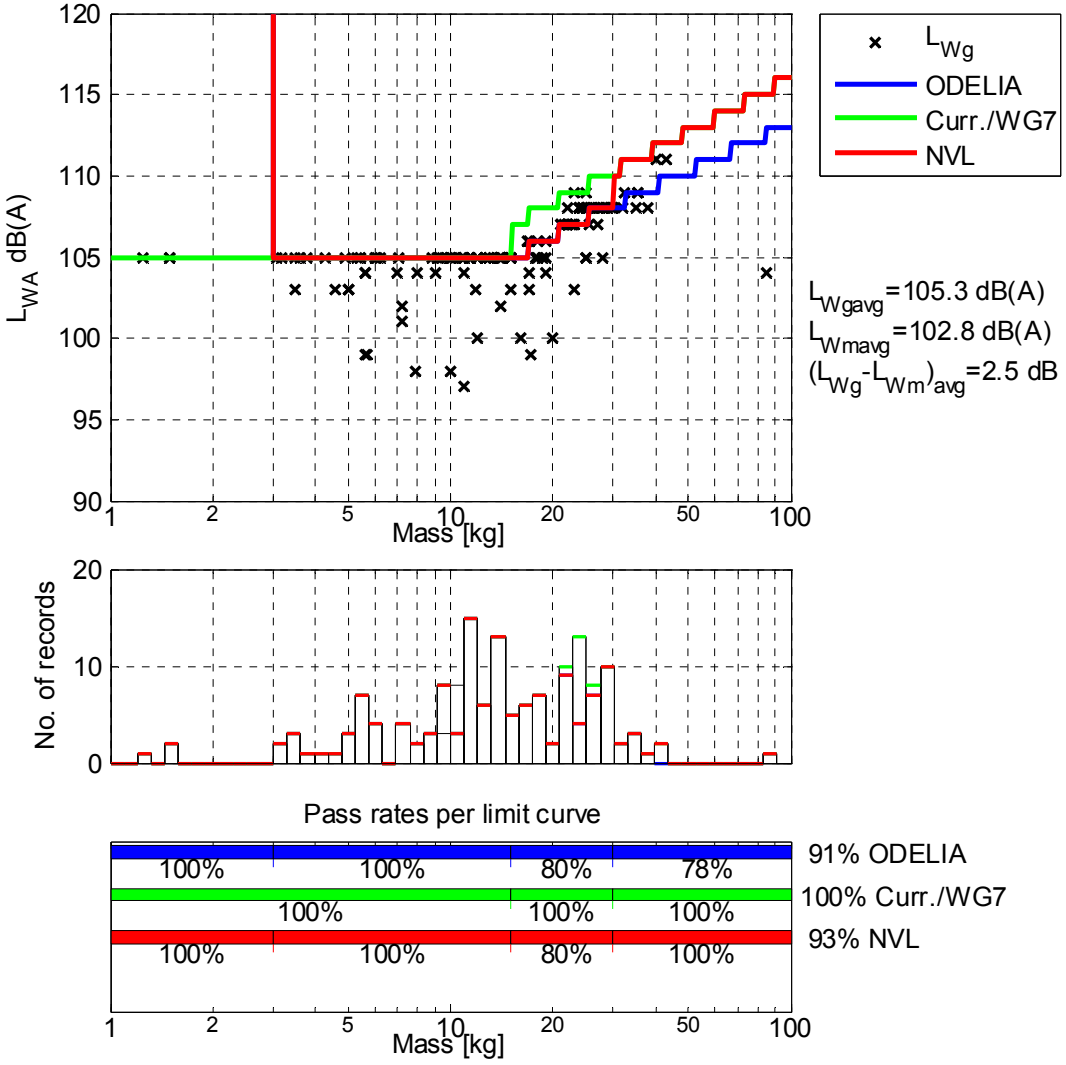
8. Compaction machines 640/764 Records (EC07-15/MARA/UK07-15)

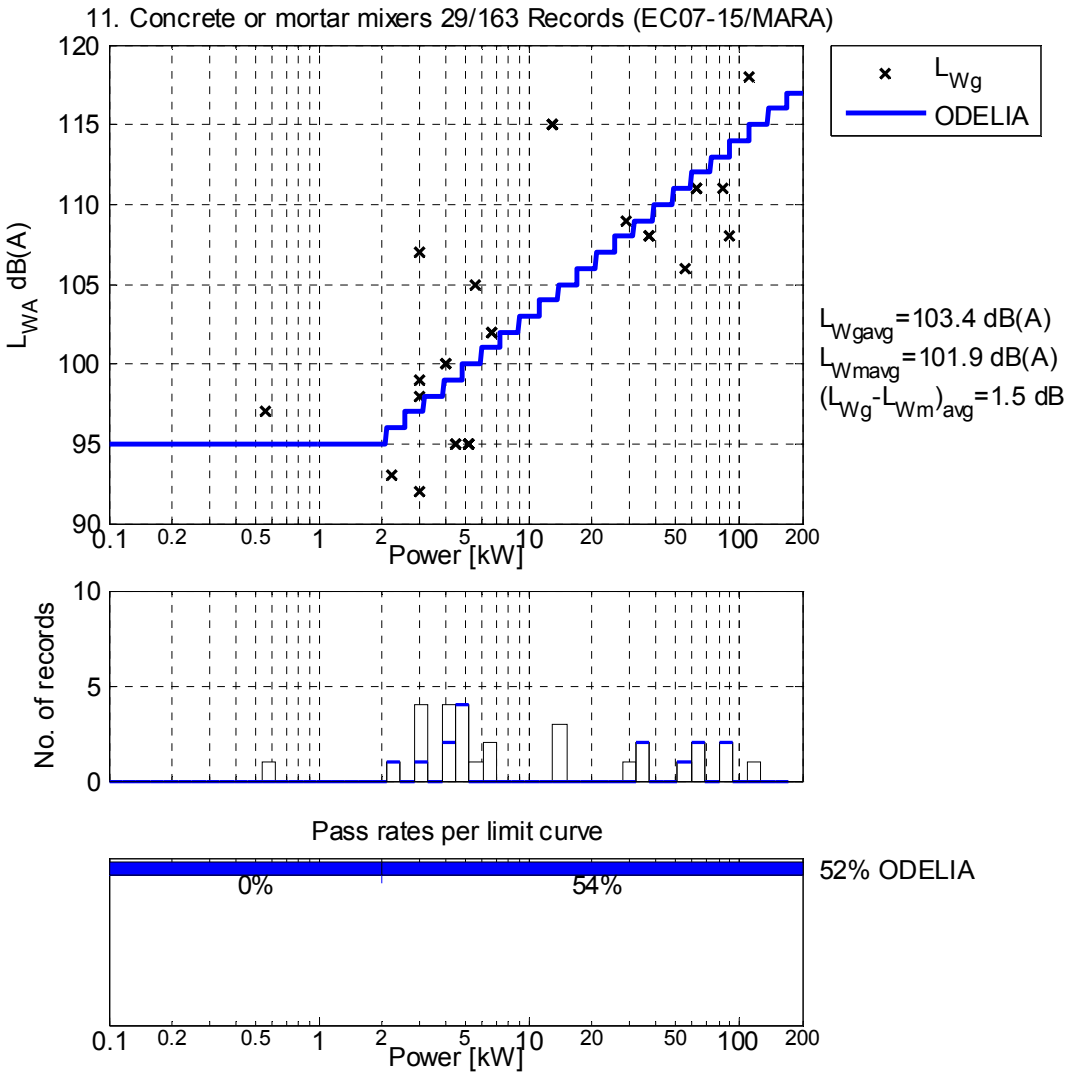


Only current limits are shown as subtypes have not been separated in the databases.
ROVR=Ride-on vibrating Rollers
VP= Vibratory plates
VRA= Vibratory rammer
WBVR = Walk-behind Vibratory Rollers

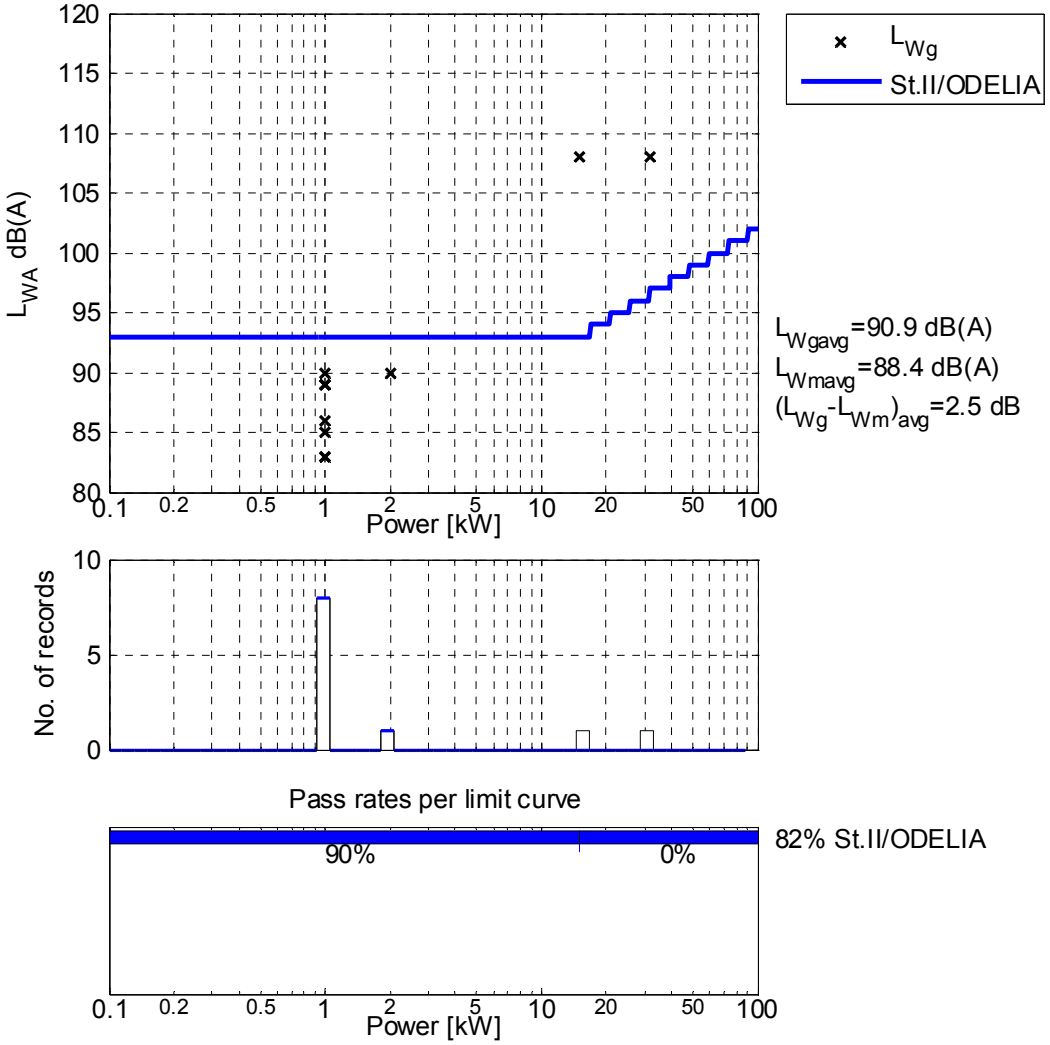

9. Compressors 476/615 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
L_{Wg}
ODELIA
St.II/NVL/WG7
L_{Wgavg}=95.7 dB(A)
L_{Wmavg}=93.8 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.9 dB
Power [kW]
No. of records
Pass rates per limit curve
58%
89%
100%
97%
69% ODELIA
99% St.II/NVL/WG7

10. Concrete breakers and picks hand-held 149/244 Records (EC07-15/MARA/UK07-15)

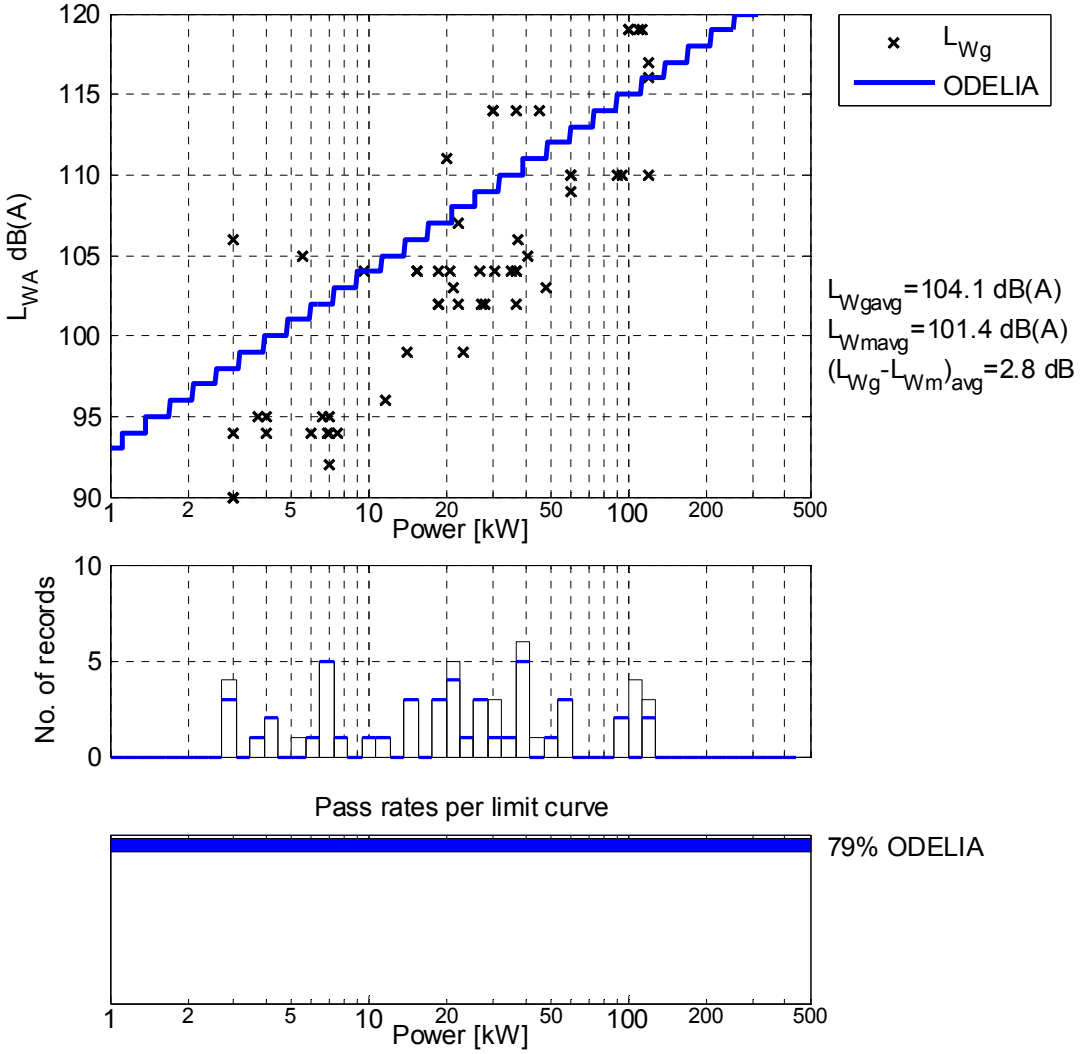


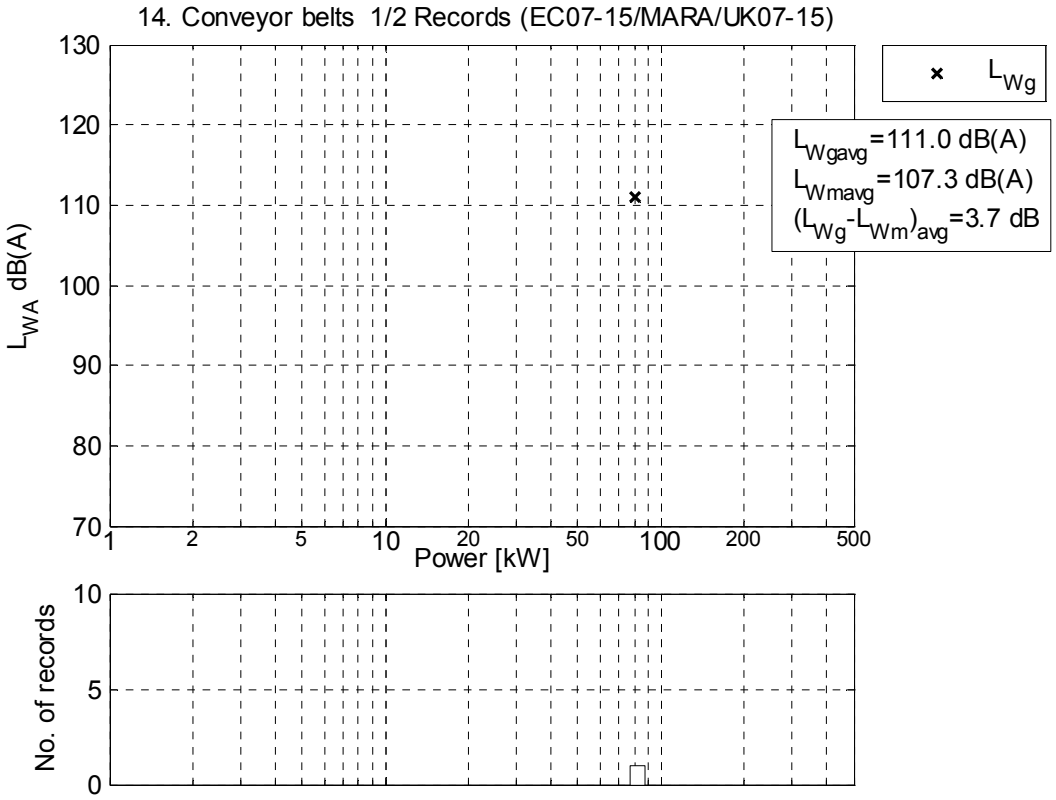

11. Concrete or mortar mixers 29/163 Records (EC07-15/MARA)
L_WA dB(A)
120
115
110
105
100
95
90
0.1
0.2
0.5
1
2
5
10
20
50
100
200
Power [kW]
L_Wg
ODELIA
L_Wgavg=103.4 dB(A)
L_Wmavg=101.9 dB(A)
(L_Wg-L_Wm)_avg=1.5 dB
No. of records
10
5
0
Pass rates per limit curve
0%
54%
52% ODELIA

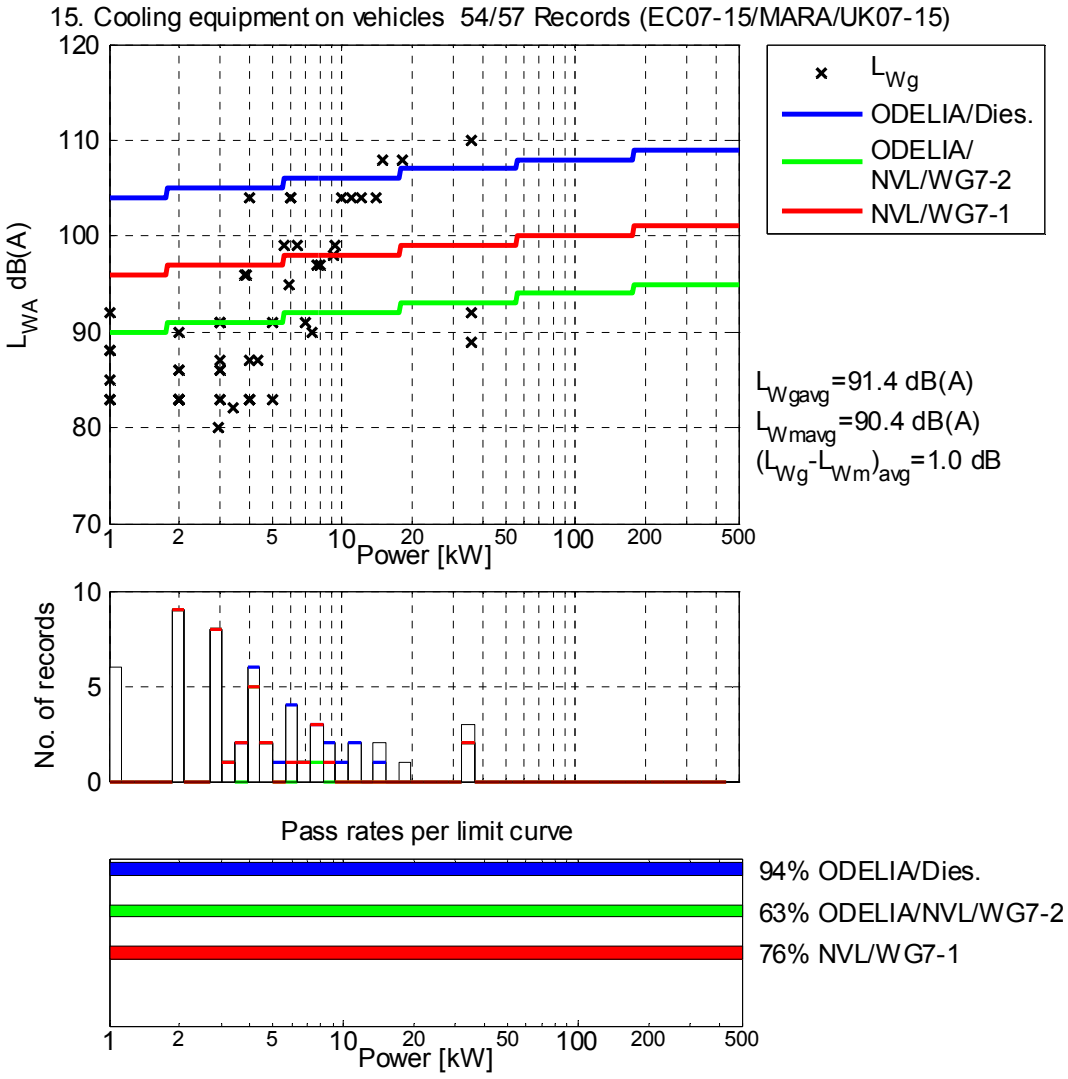
12. Construction winches (CE driven) 11/26 Records (EC07-15/MARA/UK07-15)

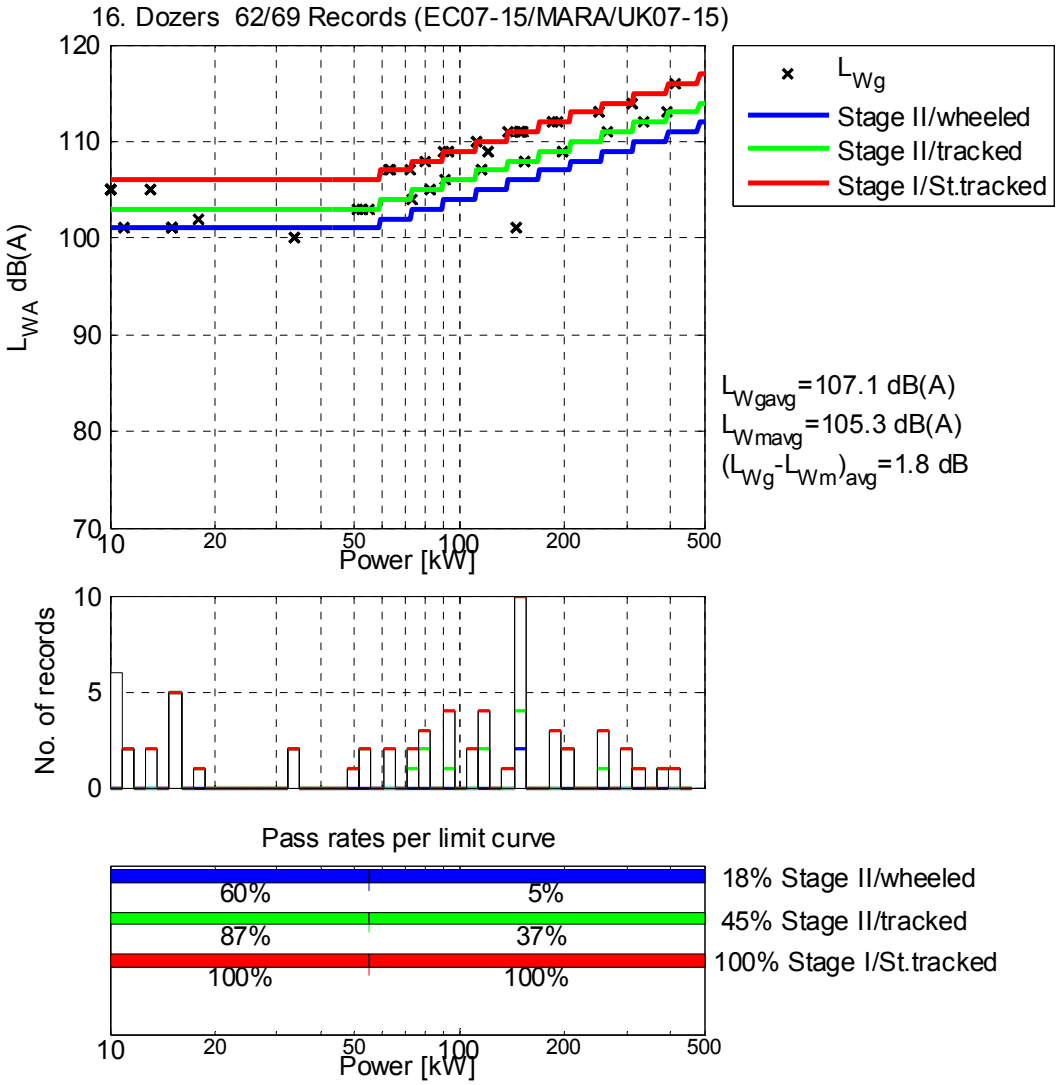


13. Conveying and spraying machines concrete/mortar 56/117 Records (EC07-15/MARA/UK

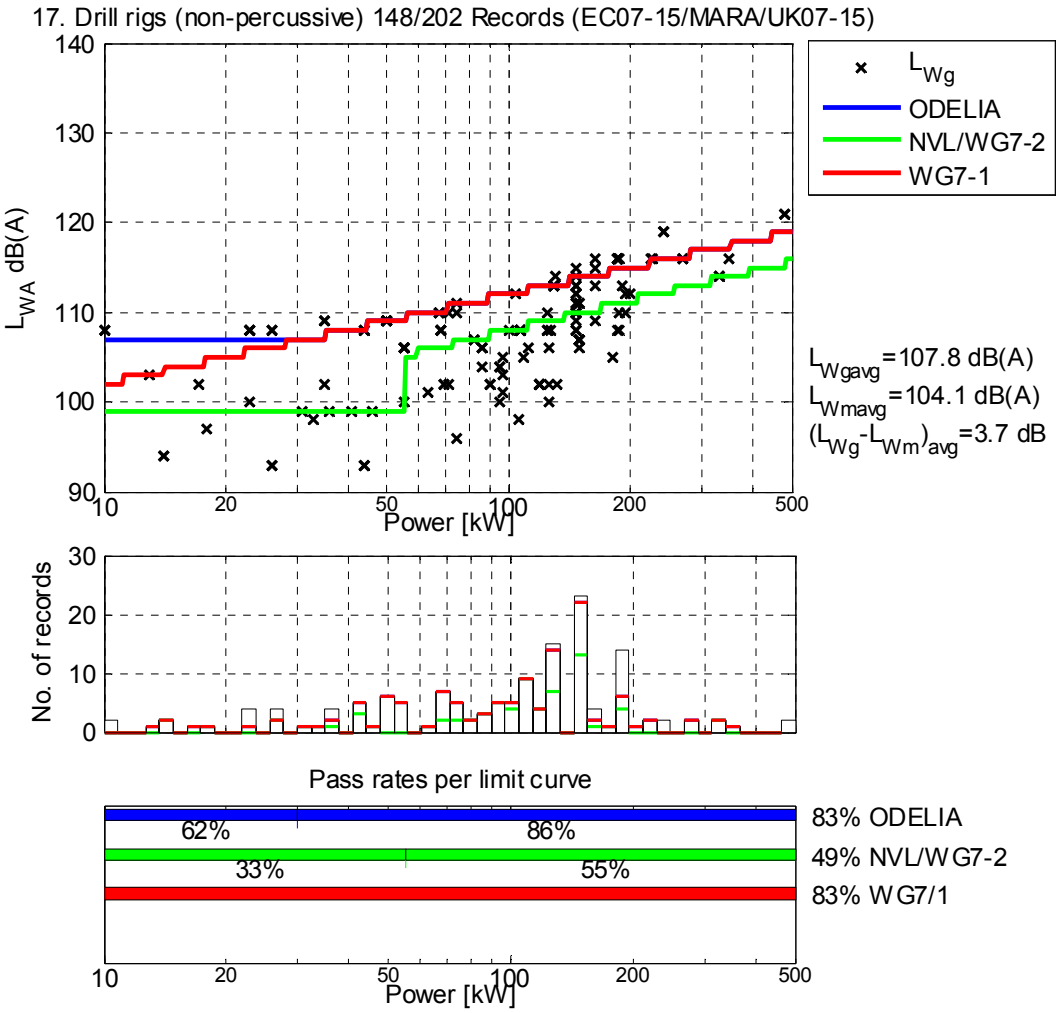


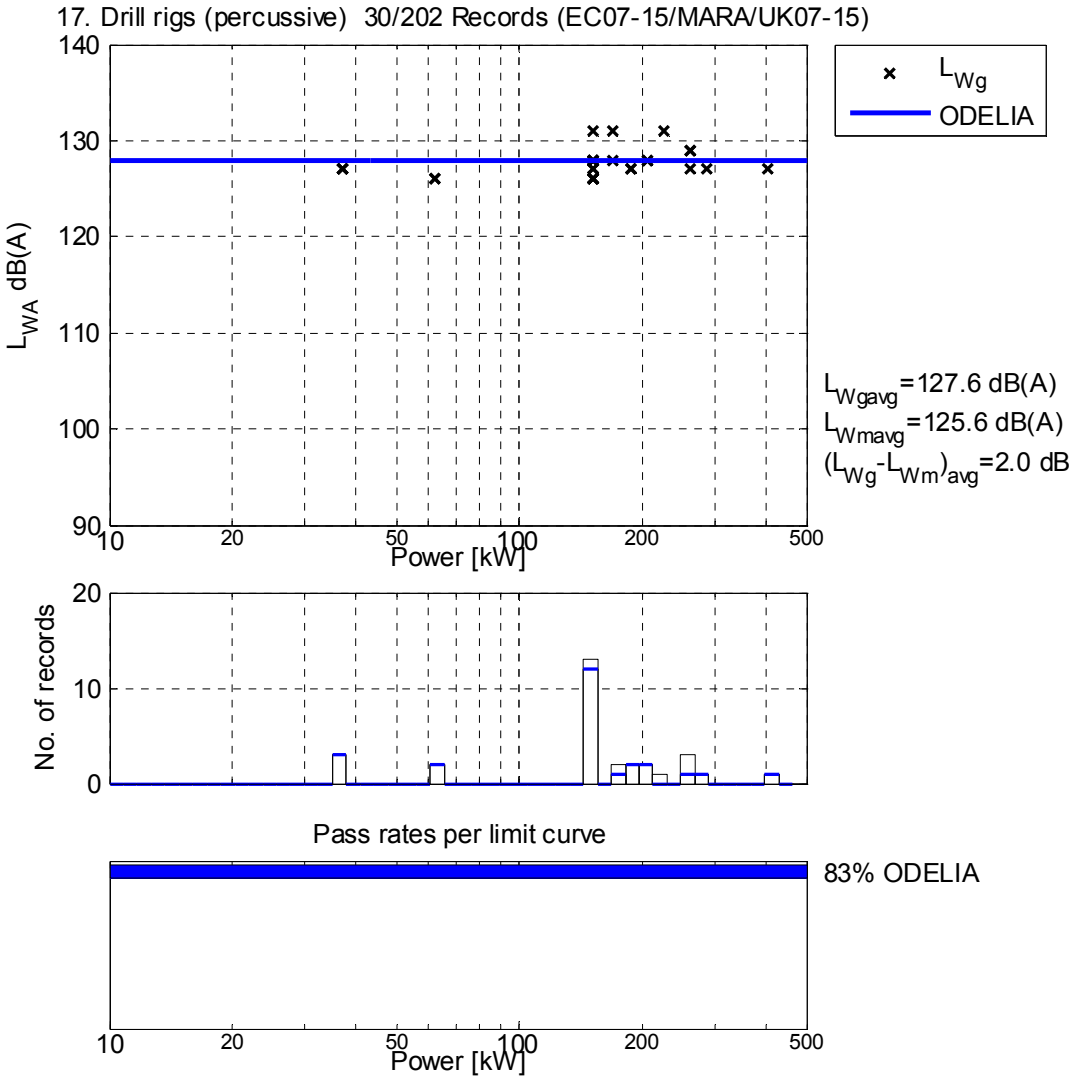

14. Conveyor belts 1/2 Records (EC07-15/MARA/UK07-15)
L_{Wg}
L_{Wgavg}=111.0 dB(A)
L_{Wmavg}=107.3 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.7 dB
L_{WA} dB(A)
Power [kW]
No. of records

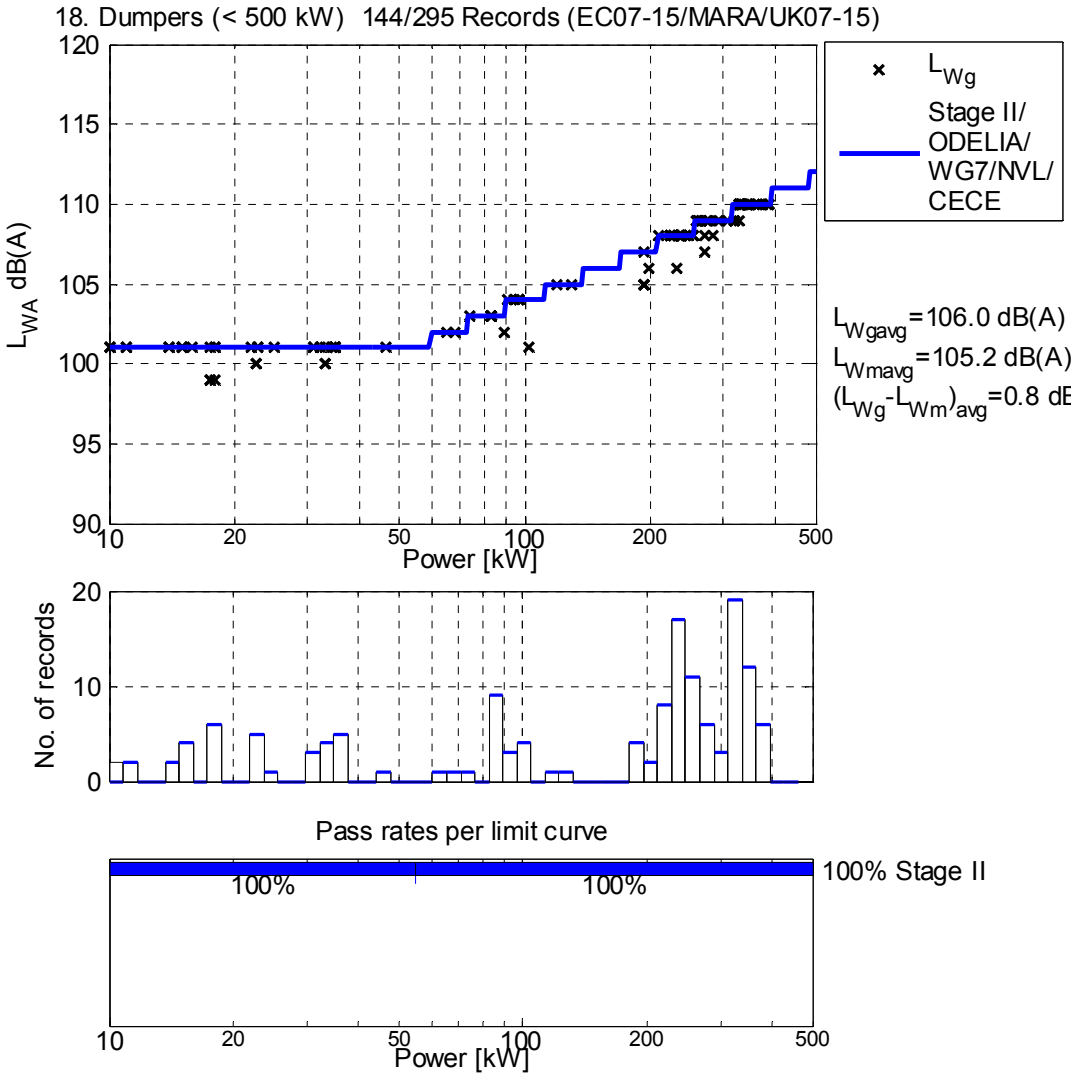

15. Cooling equipment on vehicles 54/57 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA/Dies.
ODELIA/ NVL/WG7-2
NVL/WG7-1
L_{Wgavg}=91.4 dB(A)
L_{Wmavg}=90.4 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.0 dB
No. of records
Pass rates per limit curve
94% ODELIA/Dies.
63% ODELIA/NVL/WG7-2
76% NVL/WG7-1



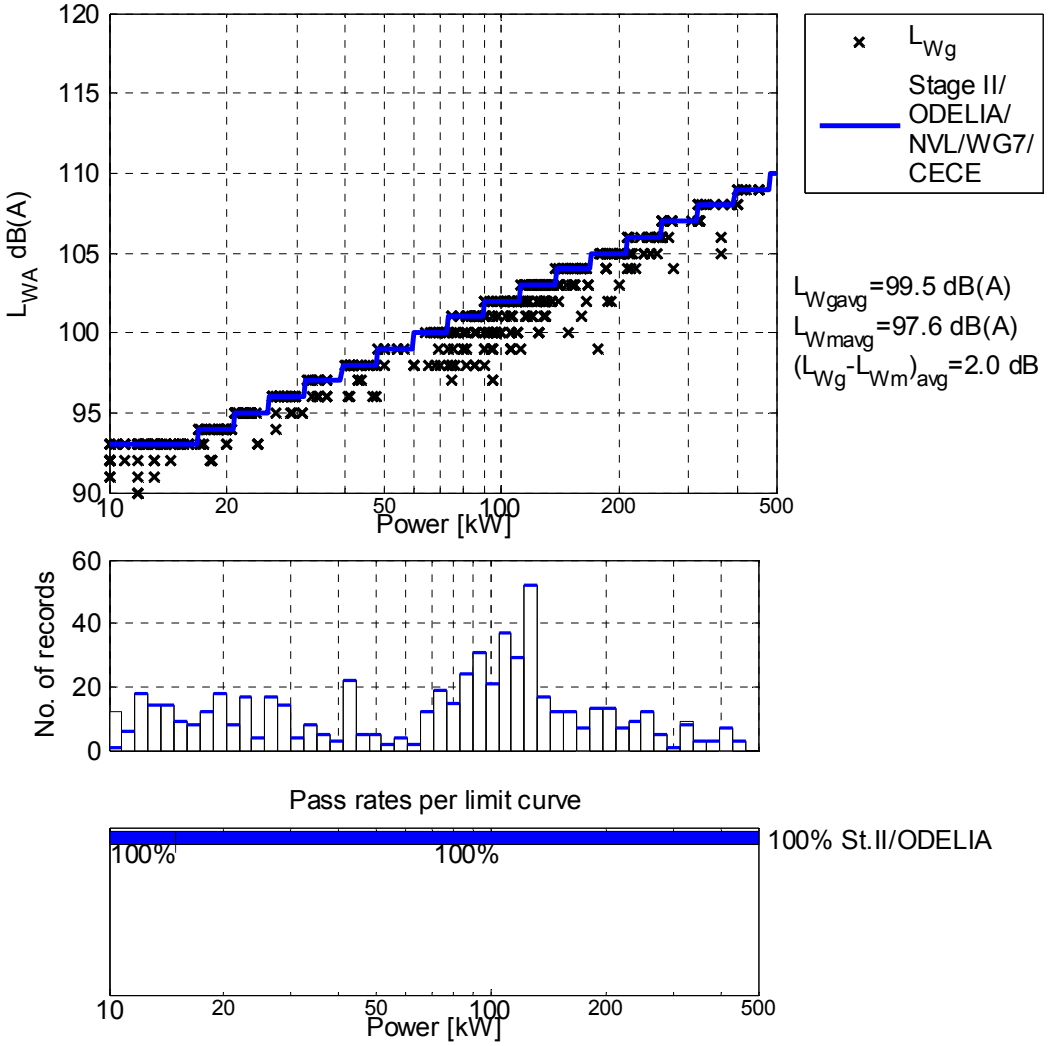
ODELIA, Nomeval, WG7, CECE same as above.


17. Drill rigs (non-percussive) 148/202 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA
NVL/WG7-2
WG7-1
L_{Wgavg}=107.8 dB(A)
L_{Wmavg}=104.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.7 dB
No. of records
Pass rates per limit curve
62%
86%
33%
55%
83% ODELIA
49% NVL/WG7-2
83% WG7/1

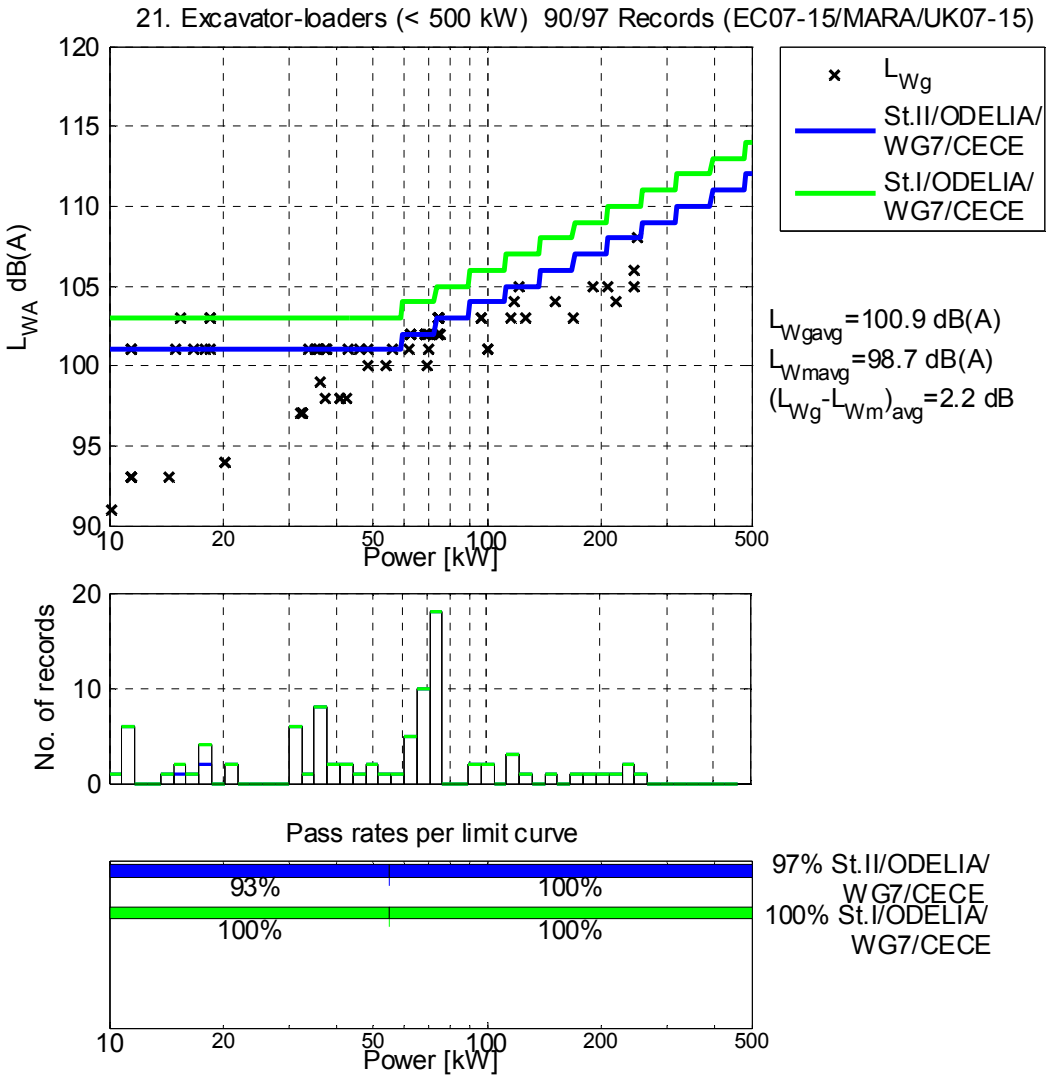

17. Drill rigs (percussive) 30/202 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
140
130
120
110
100
90
10
20
50
100
200
500
Power [kW]
L_{Wg}
ODELIA
L_{Wgavg}=127.6 dB(A)
L_{Wmavg}=125.6 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.0 dB
No. of records
20
10
0
Pass rates per limit curve
83% ODELIA
10
20
50
100
200
500
Power [kW]


18. Dumpers (< 500 kW) 144/295 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
Stage II/ ODELIA/ WG7/NVL/ CECE
L_{Wgavg}=106.0 dB(A)
L_{Wmavg}=105.2 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=0.8 dB
No. of records
Pass rates per limit curve
100%
100%
100% Stage II

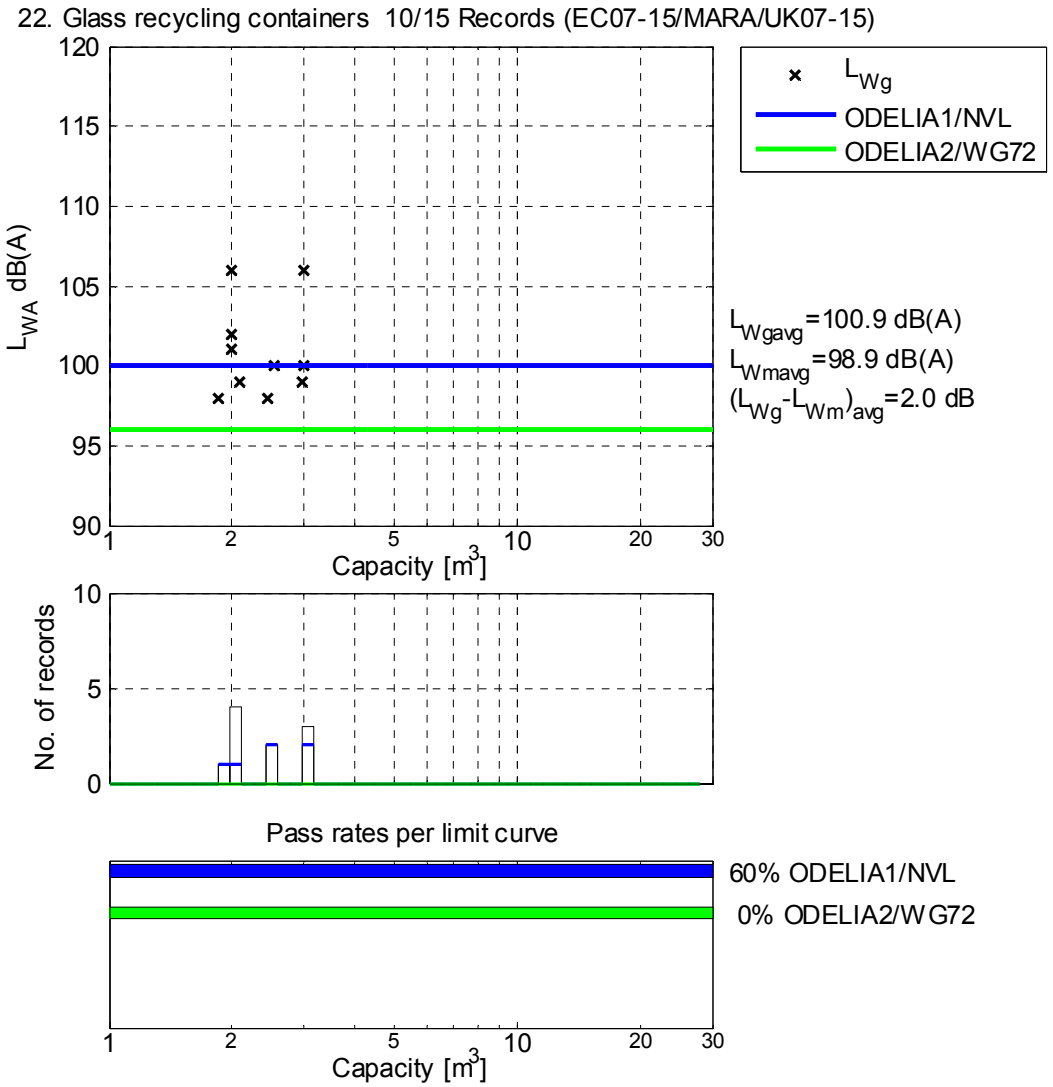
20. Excavators hydraulic or rope-operated (< 500 kW) 604/665 Records (EC07-15/MARA/L

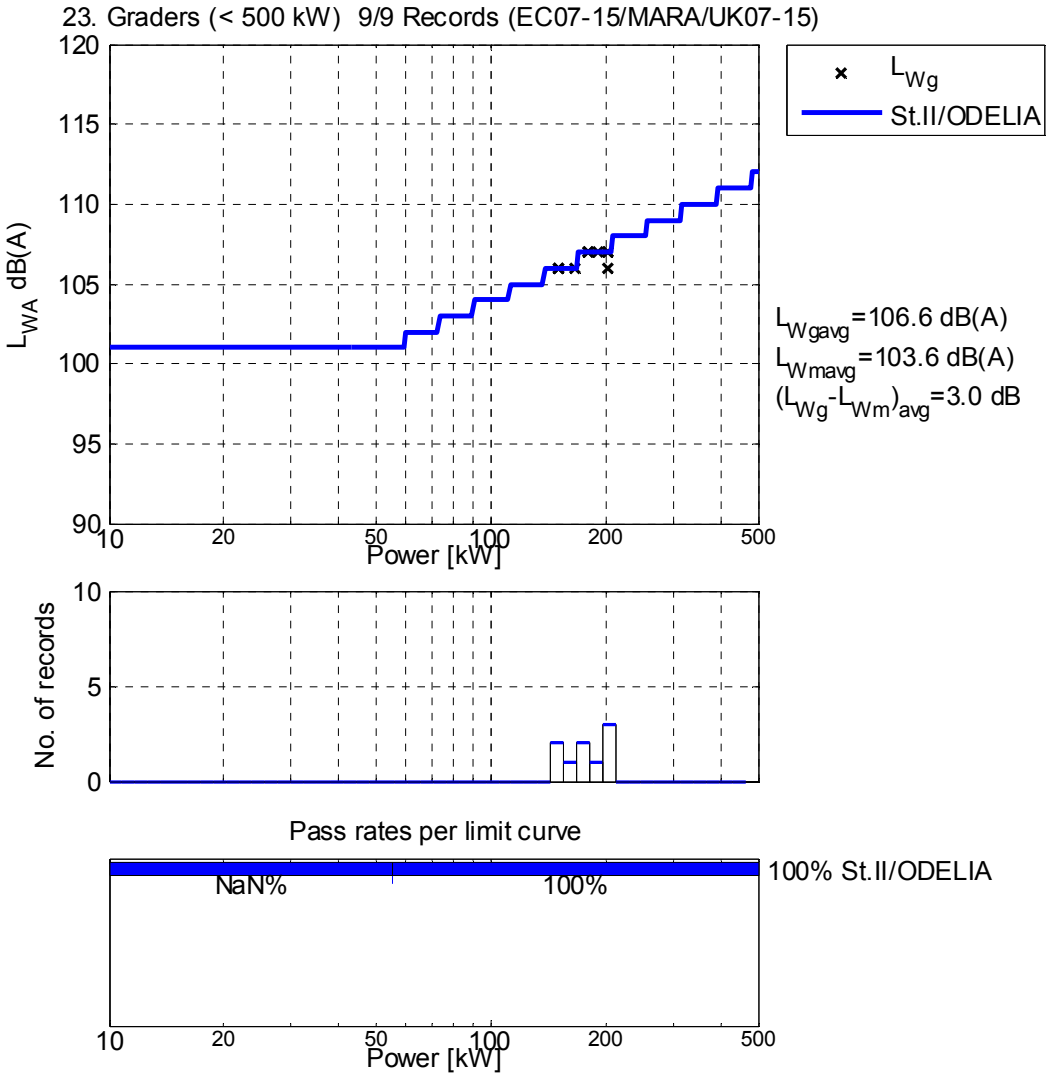


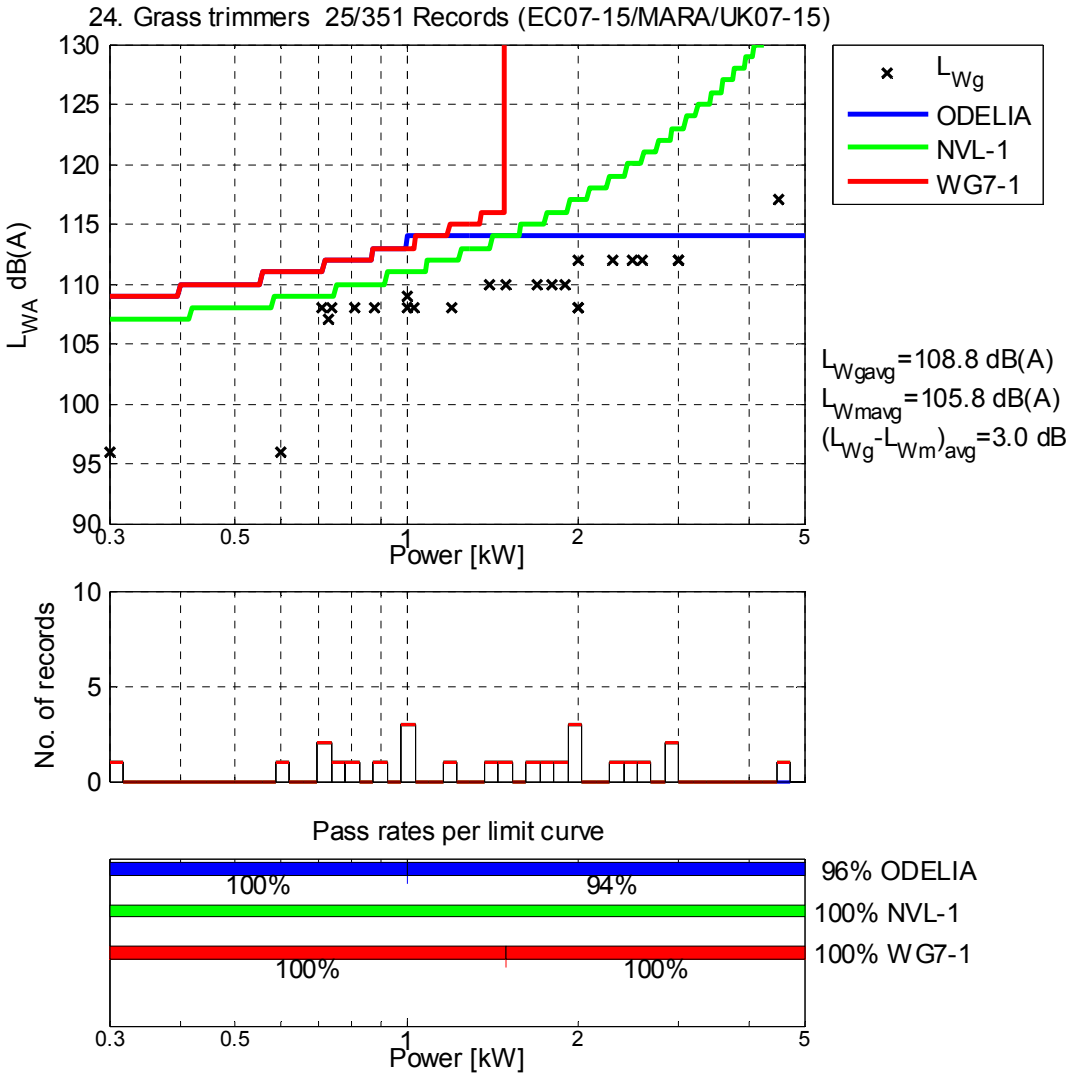
Pass rate drops to 50% with 1 dB reduction in limit



Pass rate drops to 50% with 1 dB reduction in limit

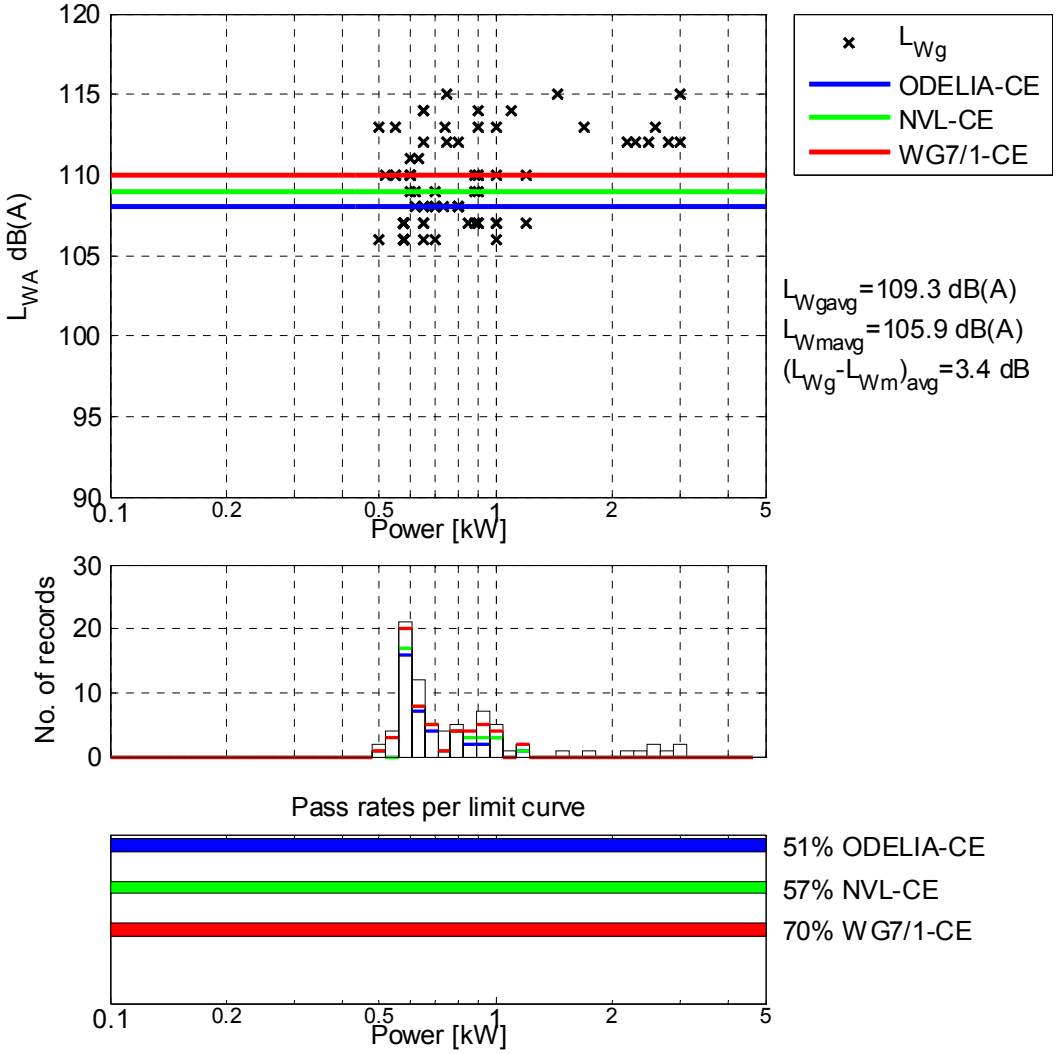

22. Glass recycling containers 10/15 Records (EC07-15/MARA/UK07-15)
L_{Wg}
ODELIA1/NVL
ODELIA2/WG72
L_{WA} dB(A)
120
115
110
105
100
95
90
1
2
5
10
20
30
Capacity [m3]
L_{Wgavg}=100.9 dB(A)
L_{Wmavg}=98.9 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.0 dB
No. of records
10
5
0
Pass rates per limit curve
60% ODELIA1/NVL
0% ODELIA2/WG72
1
2
5
10
20
30
Capacity [m3]

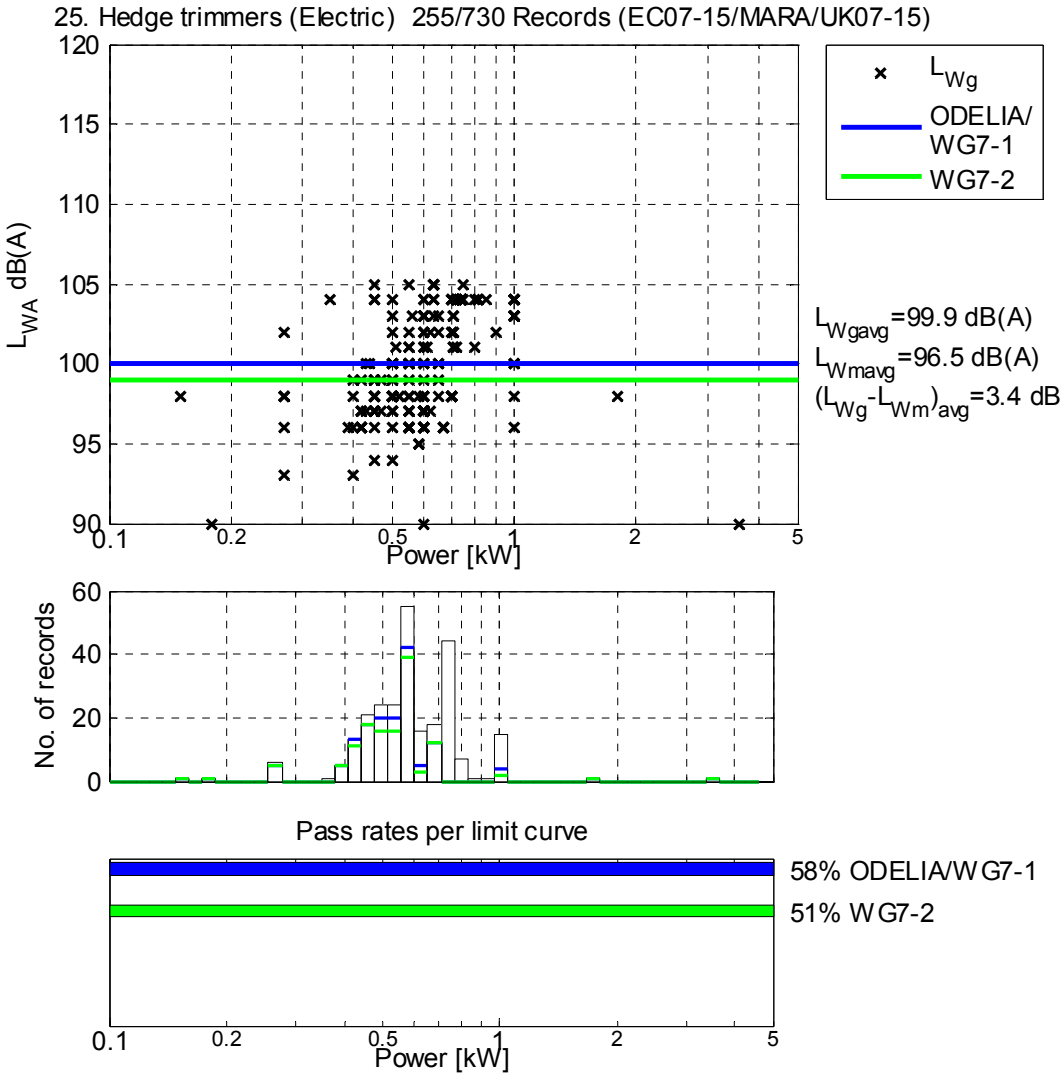

23. Graders (< 500 kW) 9/9 Records (EC07-15/MARA/UK07-15)
L_{Wg}
St.II/ODELIA
L_{WA} dB(A)
120
115
110
105
100
95
90
10
20
50
100
200
500
Power [kW]
L_{Wgavg}=106.6 dB(A)
L_{Wmavg}=103.6 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.0 dB
No. of records
10
5
0
Pass rates per limit curve
NaN%
100%
100% St.II/ODELIA
10
20
50
100
200
500
Power [kW]

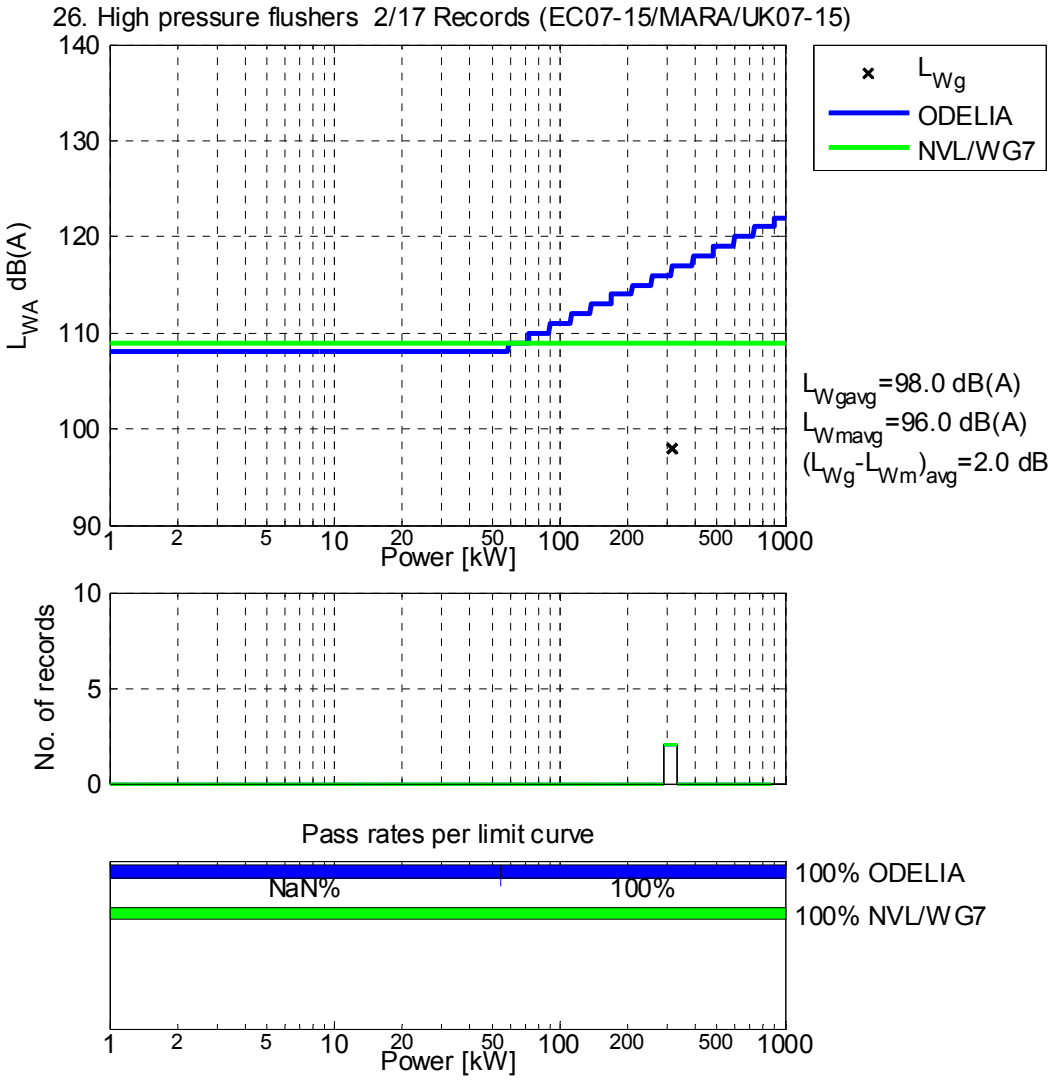


Parameter should be cutting width in mm, but power is mostly declared.

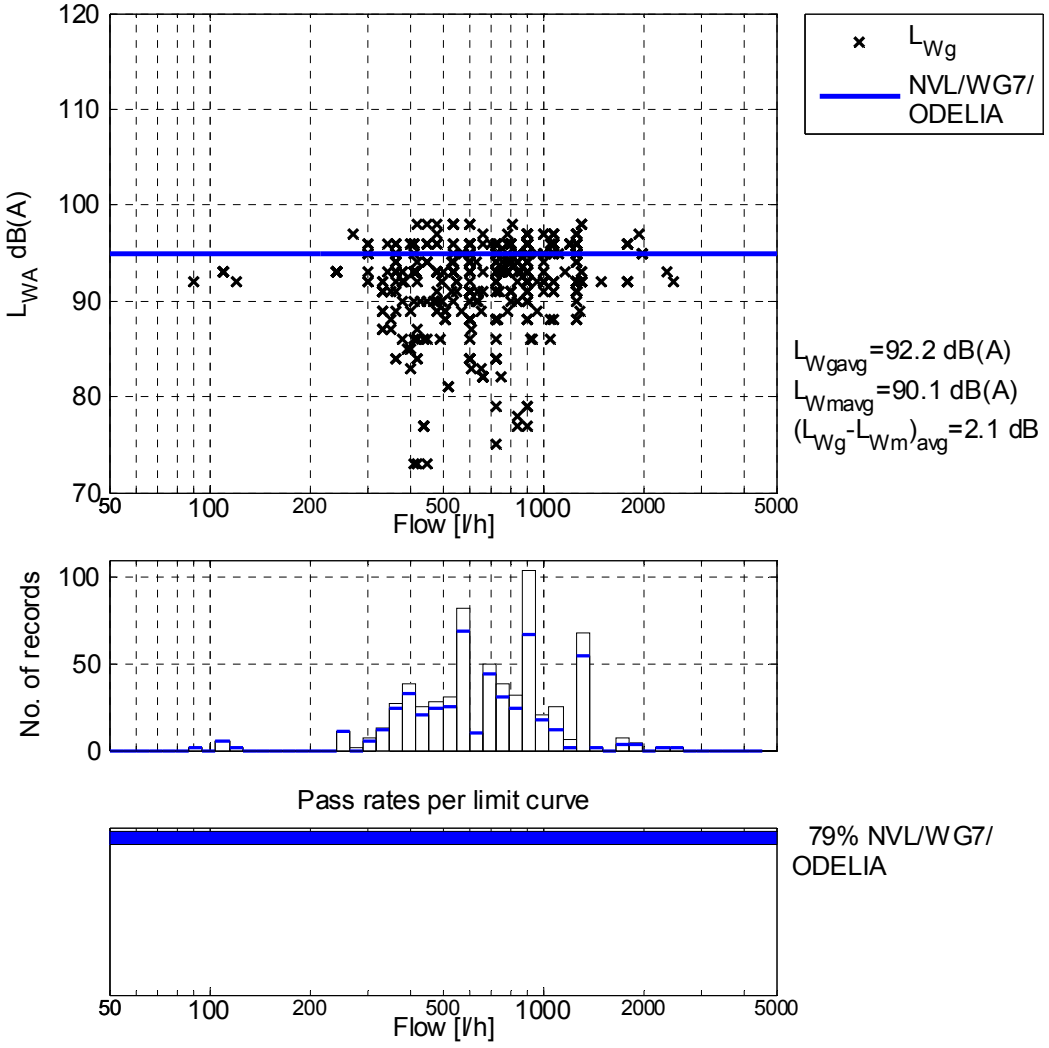
25. Hedge trimmers CE powered 81/730 Records (EC07-15/MARA/UK07-15)



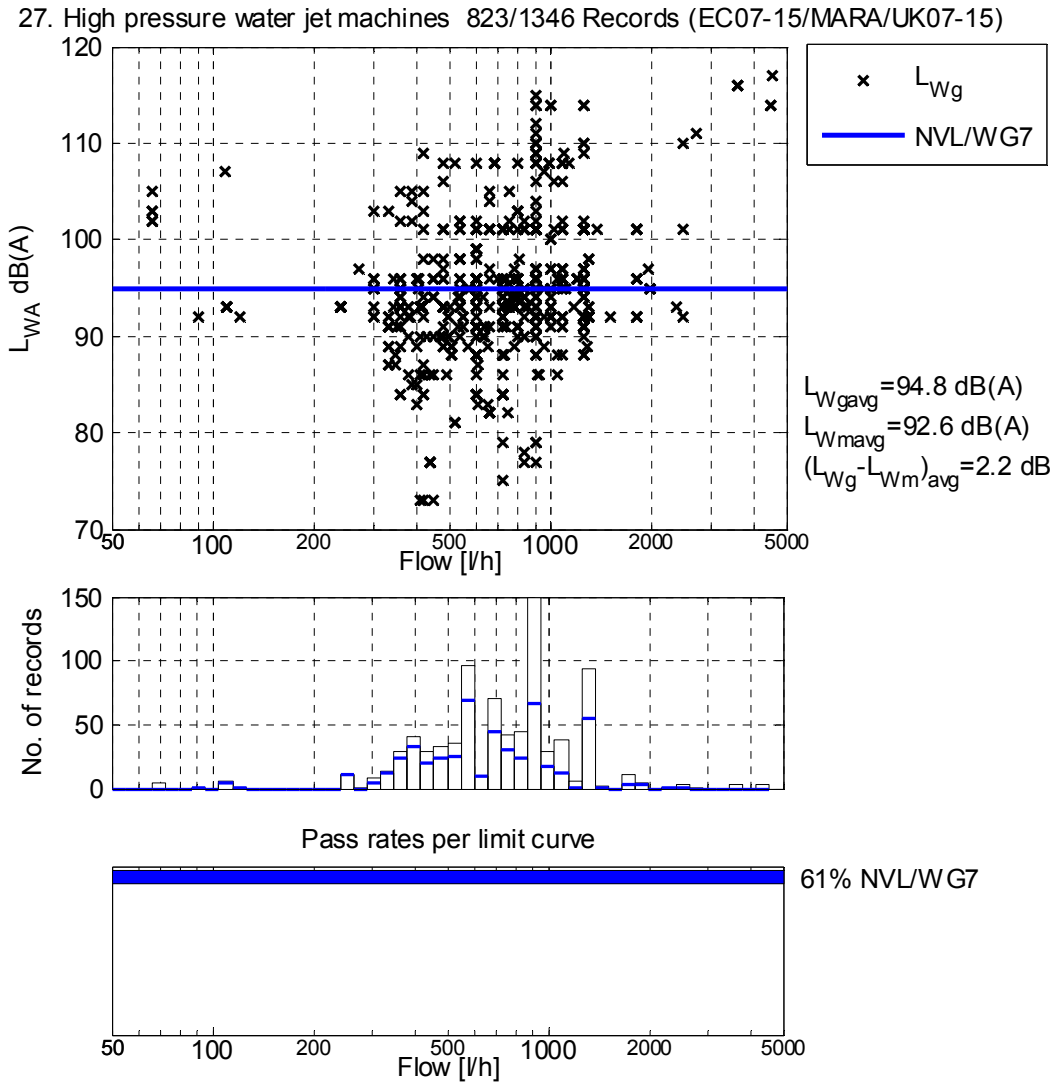

25. Hedge trimmers (Electric) 255/730 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA/ WG7-1
WG7-2
L_{Wgavg}=99.9 dB(A)
L_{Wmavg}=96.5 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.4 dB
No. of records
Pass rates per limit curve
58% ODELIA/WG7-1
51% WG7-2

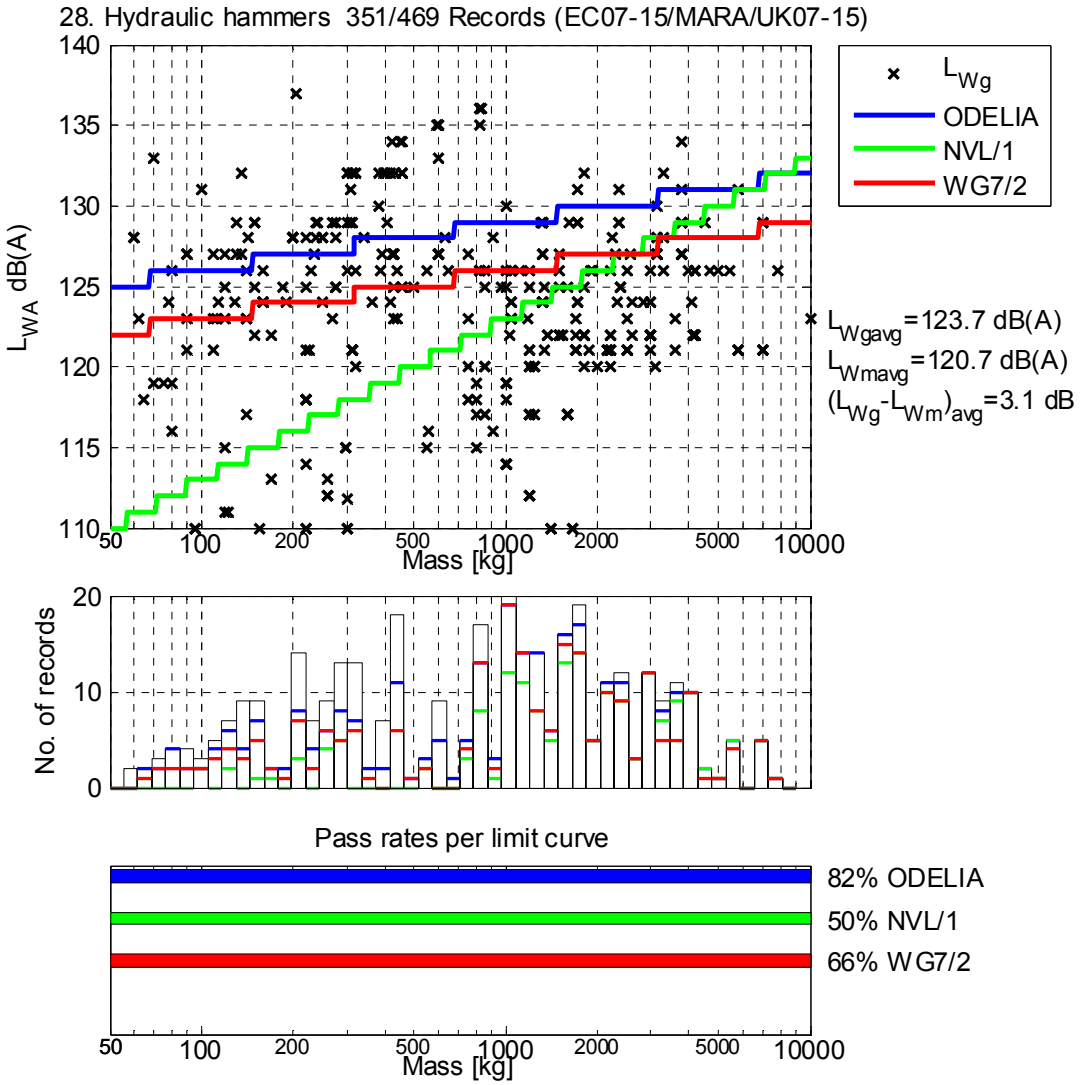

26. High pressure flushers 2/17 Records (EC07-15/MARA/UK07-15)
140
130
120
110
100
90
L_{WA} dB(A)
1
2
5
10
20
50
100
200
500
1000
Power [kW]
L_{Wg}
ODELIA
NVL/WG7
L_{Wgavg}=98.0 dB(A)
L_{Wmavg}=96.0 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.0 dB
10
5
0
No. of records
Pass rates per limit curve
NaN%
100%
100% ODELIA
100% NVL/WG7
1
2
5
10
20
50
100
200
500
1000
Power [kW]

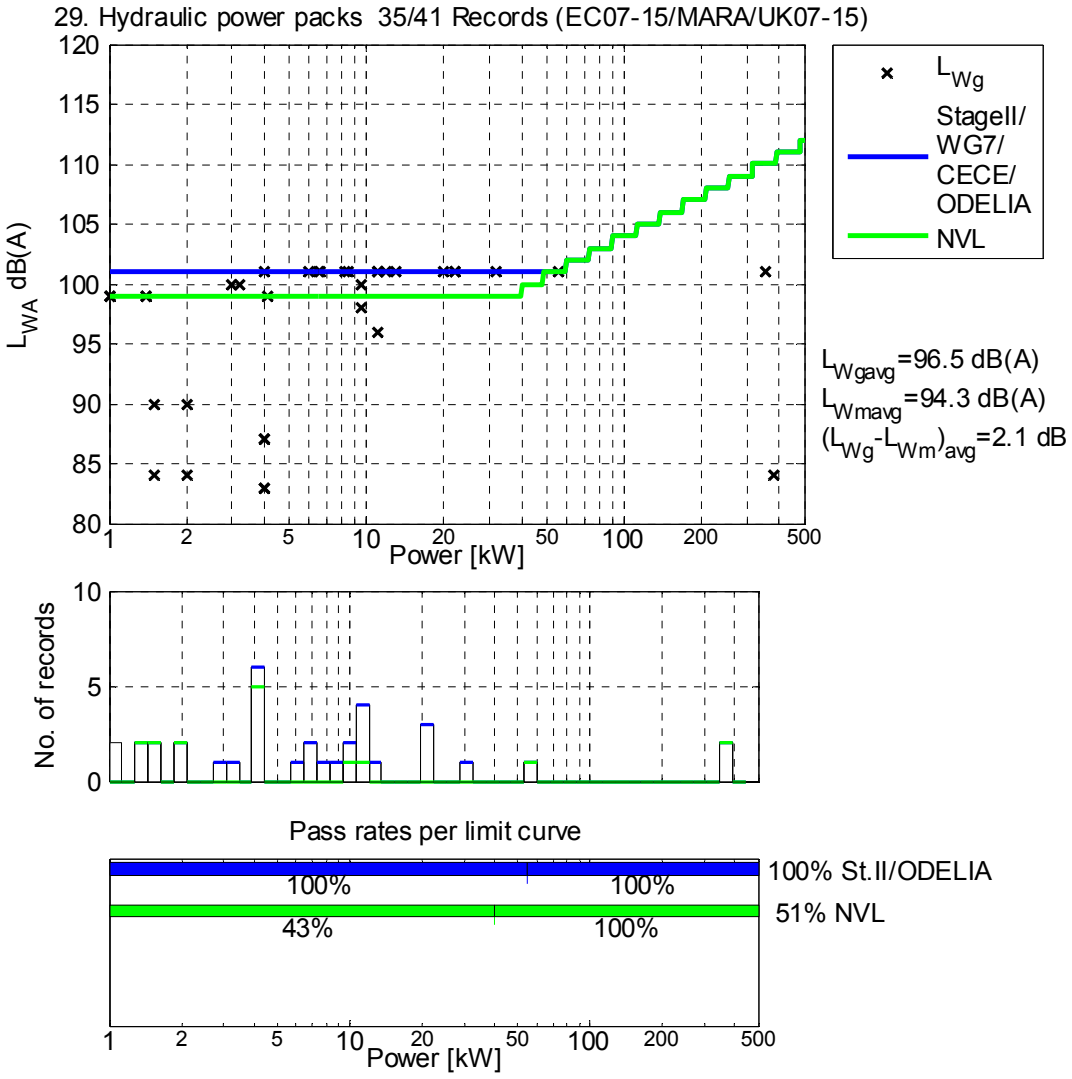
27. High pressure water jet machines 637/1346 Records (EC07-15/MARA/UK07-15)

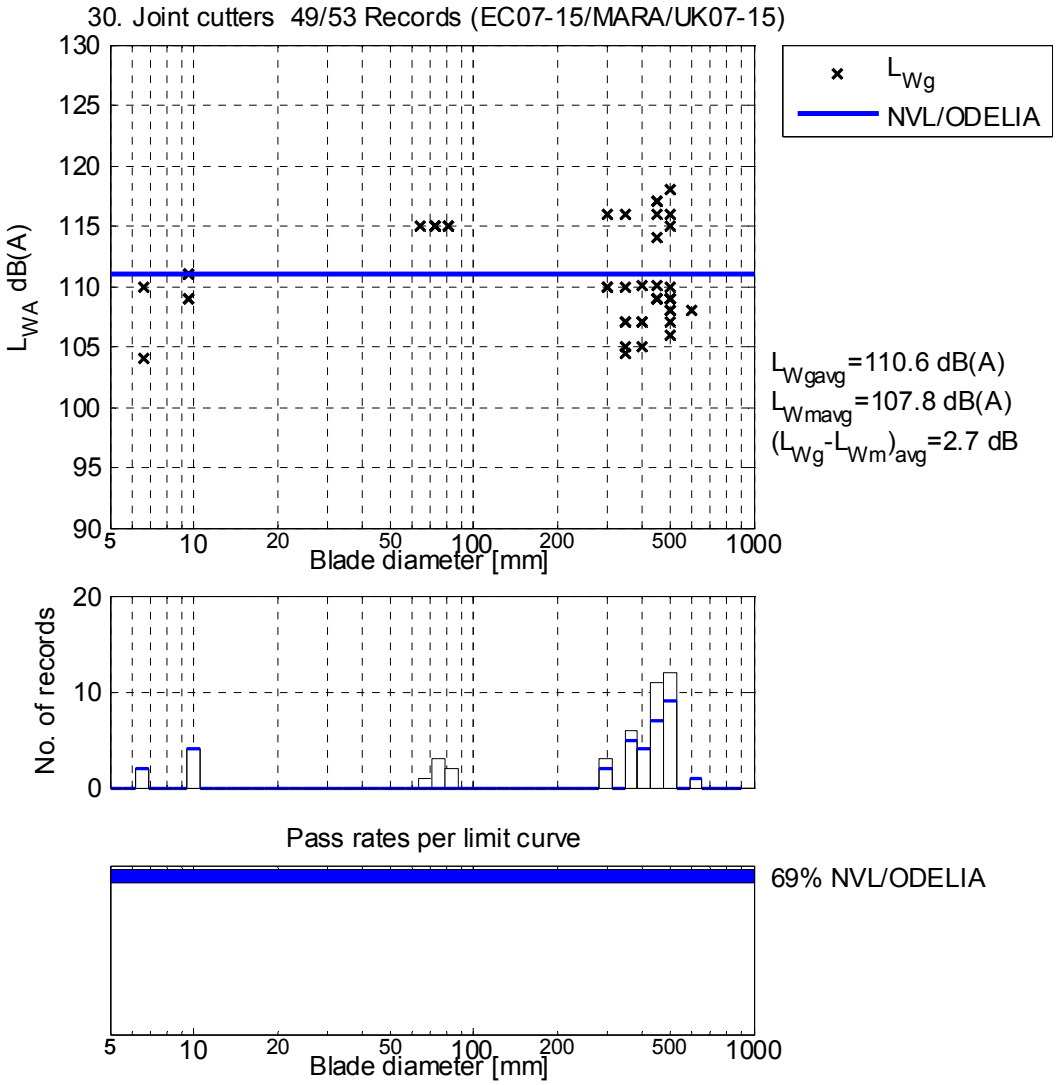


Only smaller units are shown here; the ODELIA limit is not actually proposed due to low environmental impact, assuming equipment numbers are no more than 1 million in the EU.

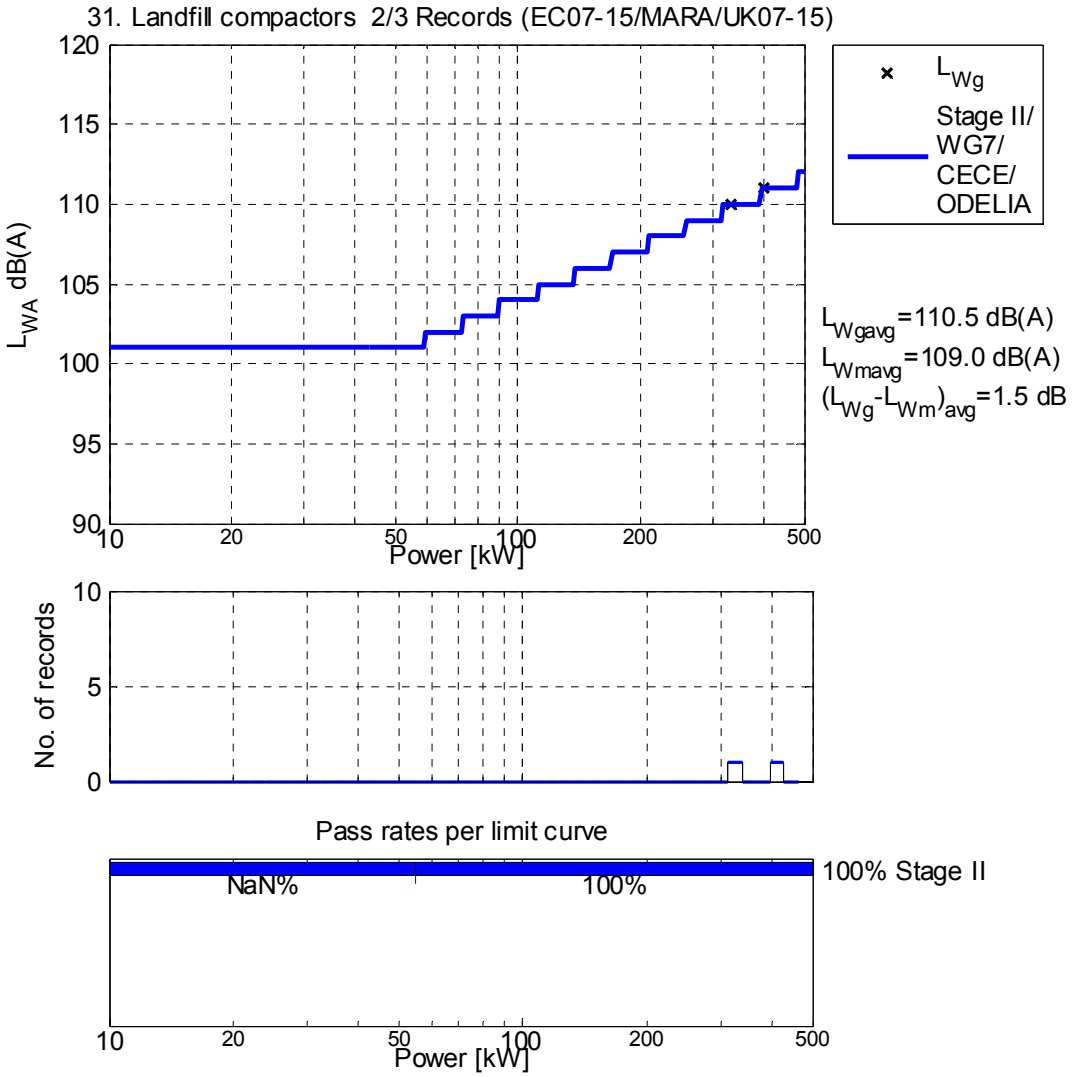

27. High pressure water jet machines 823/1346 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Flow [l/h]
L_{Wg}
NVL/WG7
L_{Wgavg}=94.8 dB(A)
L_{Wmavg}=92.6 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.2 dB
No. of records
Pass rates per limit curve
61% NVL/WG7

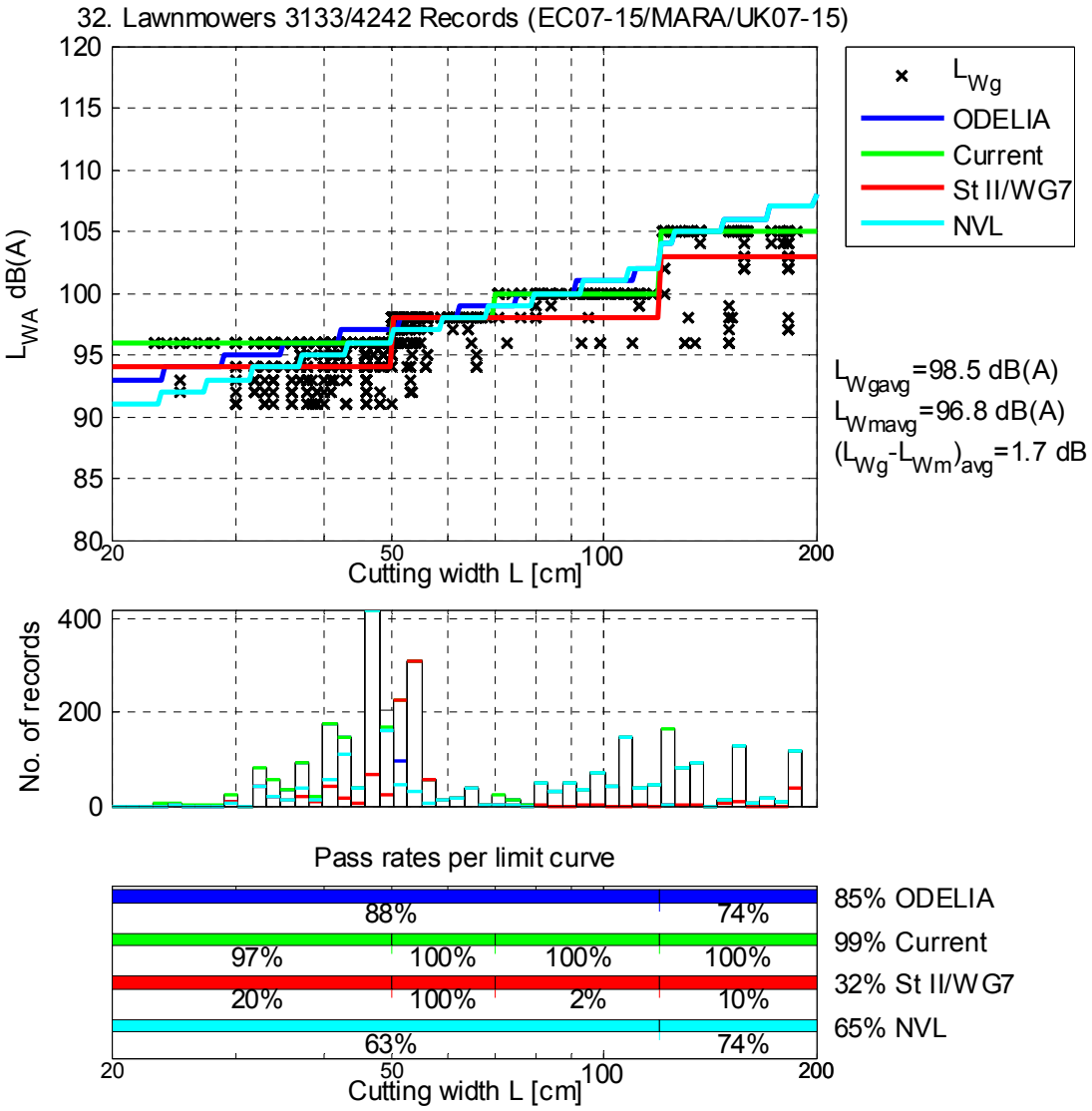

28. Hydraulic hammers 351/469 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Mass [kg]
L_{Wg}
ODELIA
NVL/1
WG7/2
L_{Wgavg}=123.7 dB(A)
L_{Wmavg}=120.7 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.1 dB
No. of records
Pass rates per limit curve
82% ODELIA
50% NVL/1
66% WG7/2

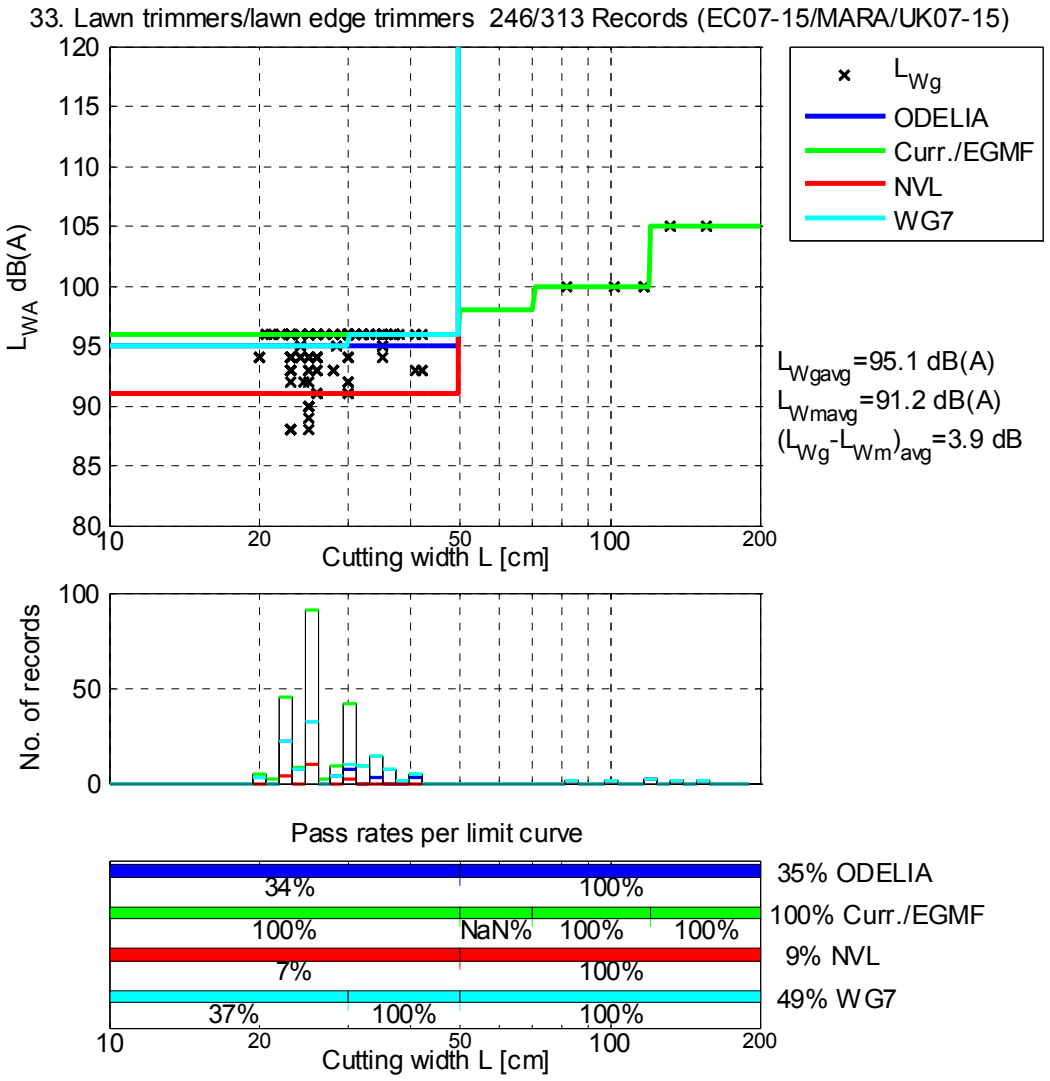

29. Hydraulic power packs 35/41 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
StageII/ WG7/ CECE/ ODELIA
NVL
L_{Wgavg}=96.5 dB(A)
L_{Wmavg}=94.3 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.1 dB
No. of records
Pass rates per limit curve
100% 100%
100% St.II/ODELIA
43% 100%
51% NVL
Power [kW]

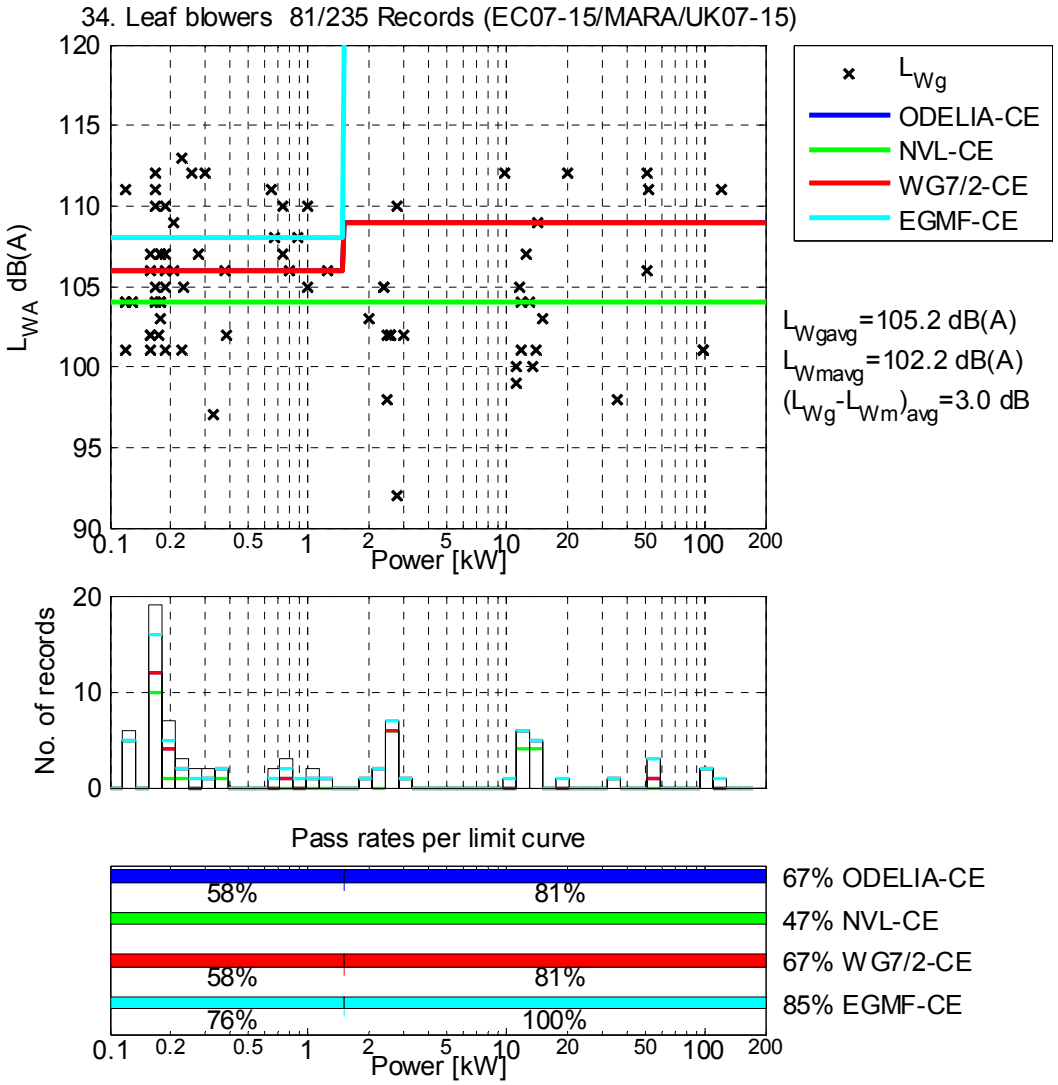


Note: 5-10 mm range is actually power

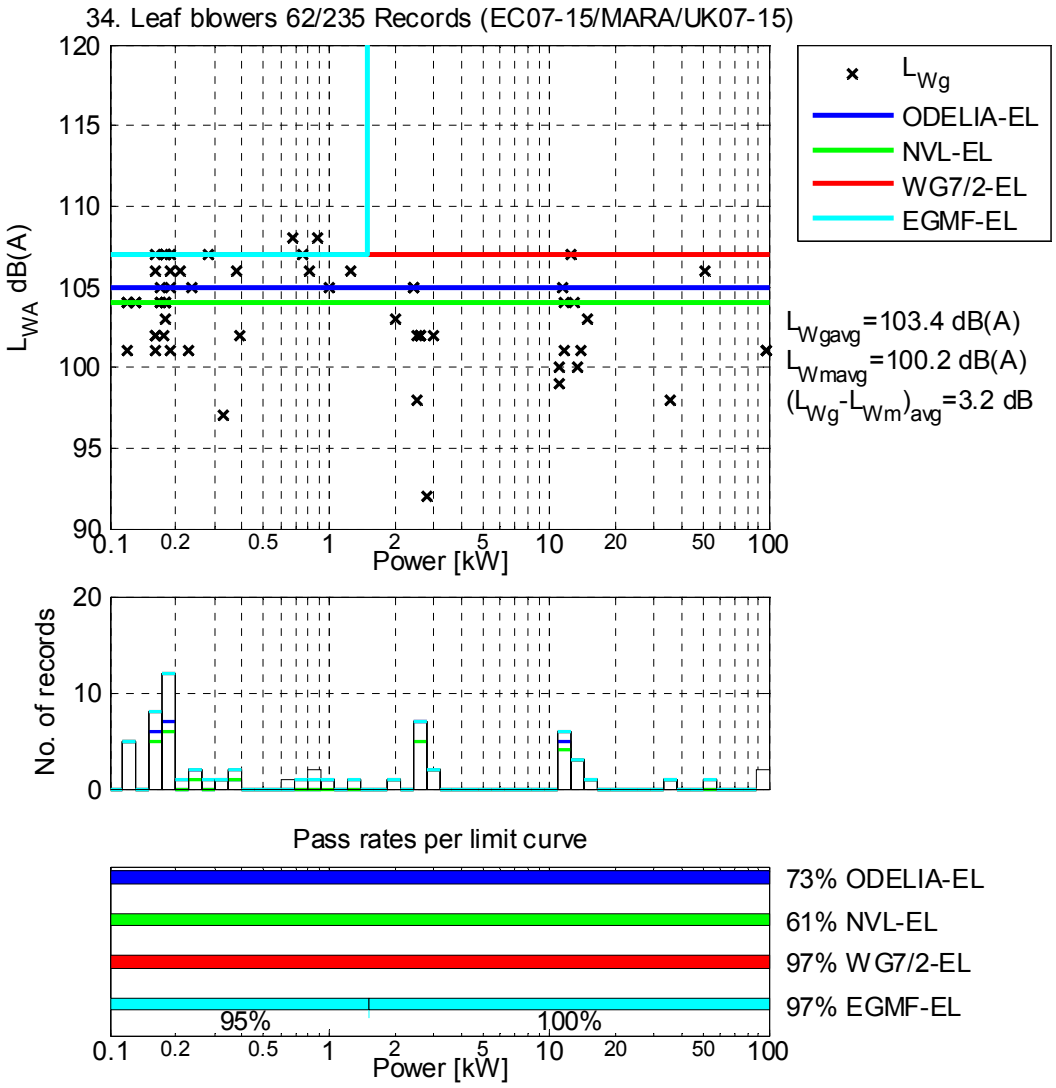

31. Landfill compactors 2/3 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
120
115
110
105
100
95
90
10
20
50
100
200
500
Power [kW]
L_{Wg}
Stage II/ WG7/ CECE/ ODELIA
L_{Wgavg}=110.5 dB(A)
L_{Wmavg}=109.0 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.5 dB
No. of records
10
5
0
Pass rates per limit curve
NaN%
100%
100% Stage II
10
20
50
100
200
500
Power [kW]

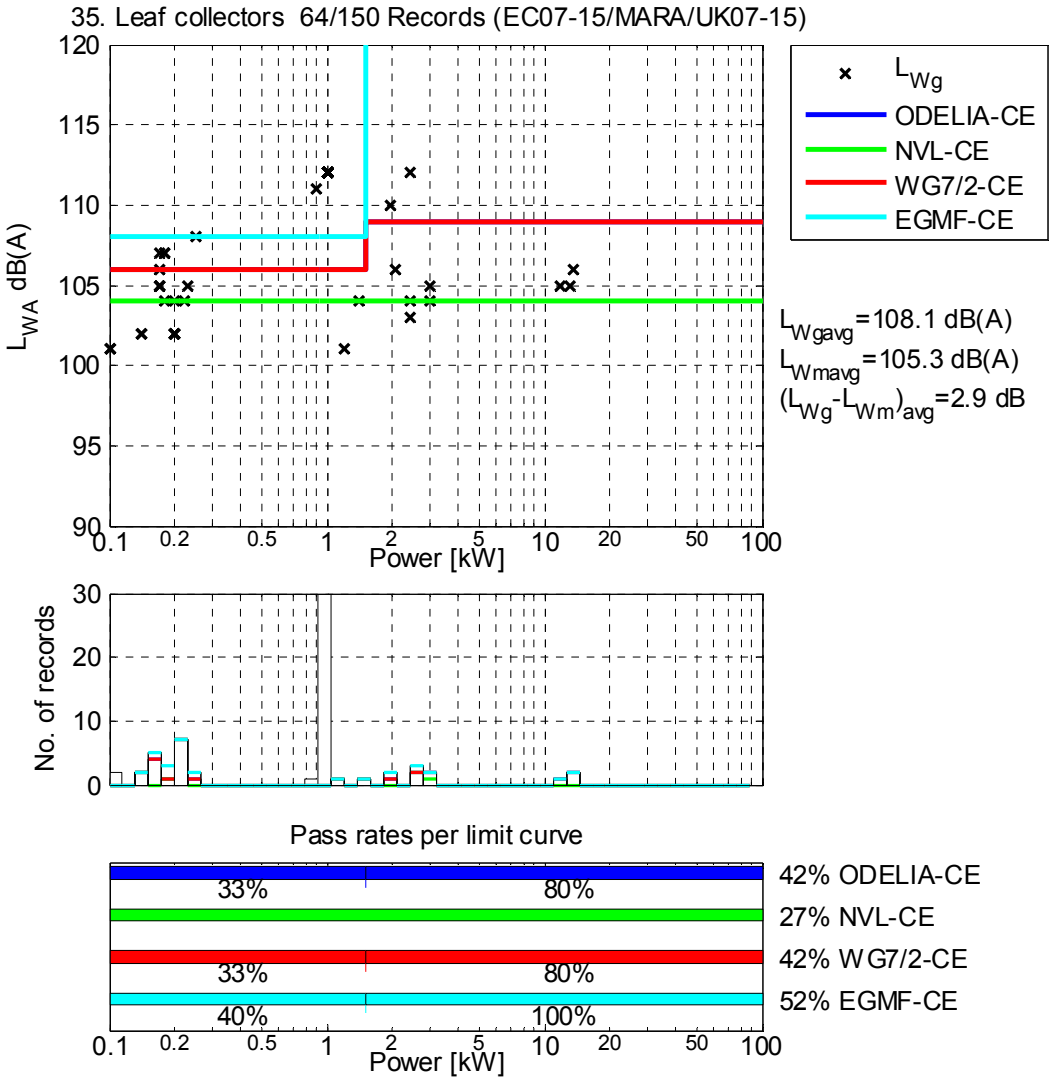

32. Lawnmowers 3133/4242 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
120
115
110
105
100
95
90
85
80
20
50
100
200
Cutting width L [cm]
L_{Wg}
ODELIA
Current
St II/WG7
NVL
L_{Wgavg}=98.5 dB(A)
L_{Wmavg}=96.8 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.7 dB
No. of records
400
200
0
Pass rates per limit curve
88%
74%
97%
100%
100%
100%
20%
100%
2%
10%
63%
74%
85% ODELIA
99% Current
32% St II/WG7
65% NVL
20
50
100
200
Cutting width L [cm]


33. Lawn trimmers/lawn edge trimmers 246/313 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Cutting width L [cm]
L_{Wg}
ODELIA
Curr./EGMF
NVL
WG7
L_{Wgavg}=95.1 dB(A)
L_{Wmavg}=91.2 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.9 dB
No. of records
Pass rates per limit curve
34% 100%
100% NaN% 100% 100%
7% 100%
37% 100% 100%
35% ODELIA
100% Curr./EGMF
9% NVL
49% WG7

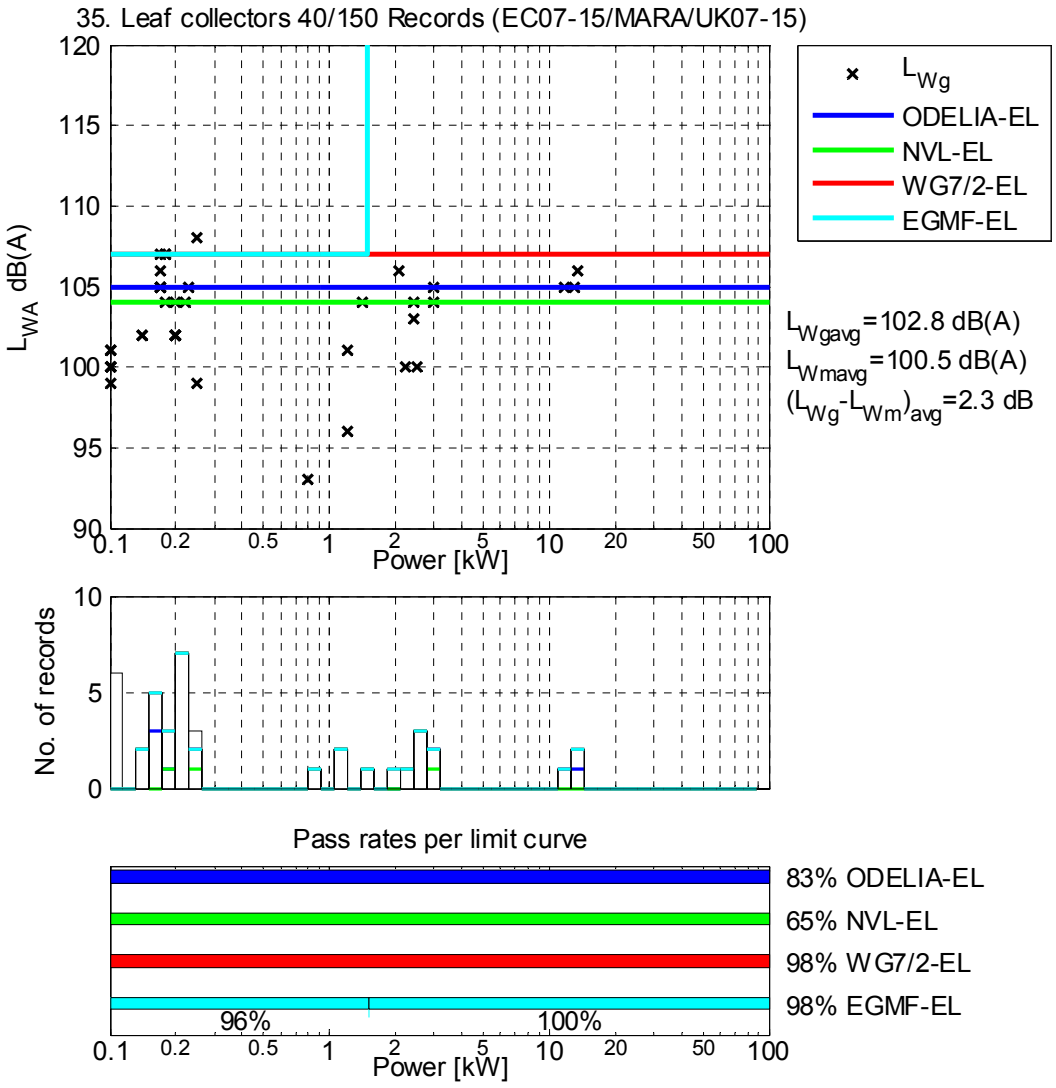


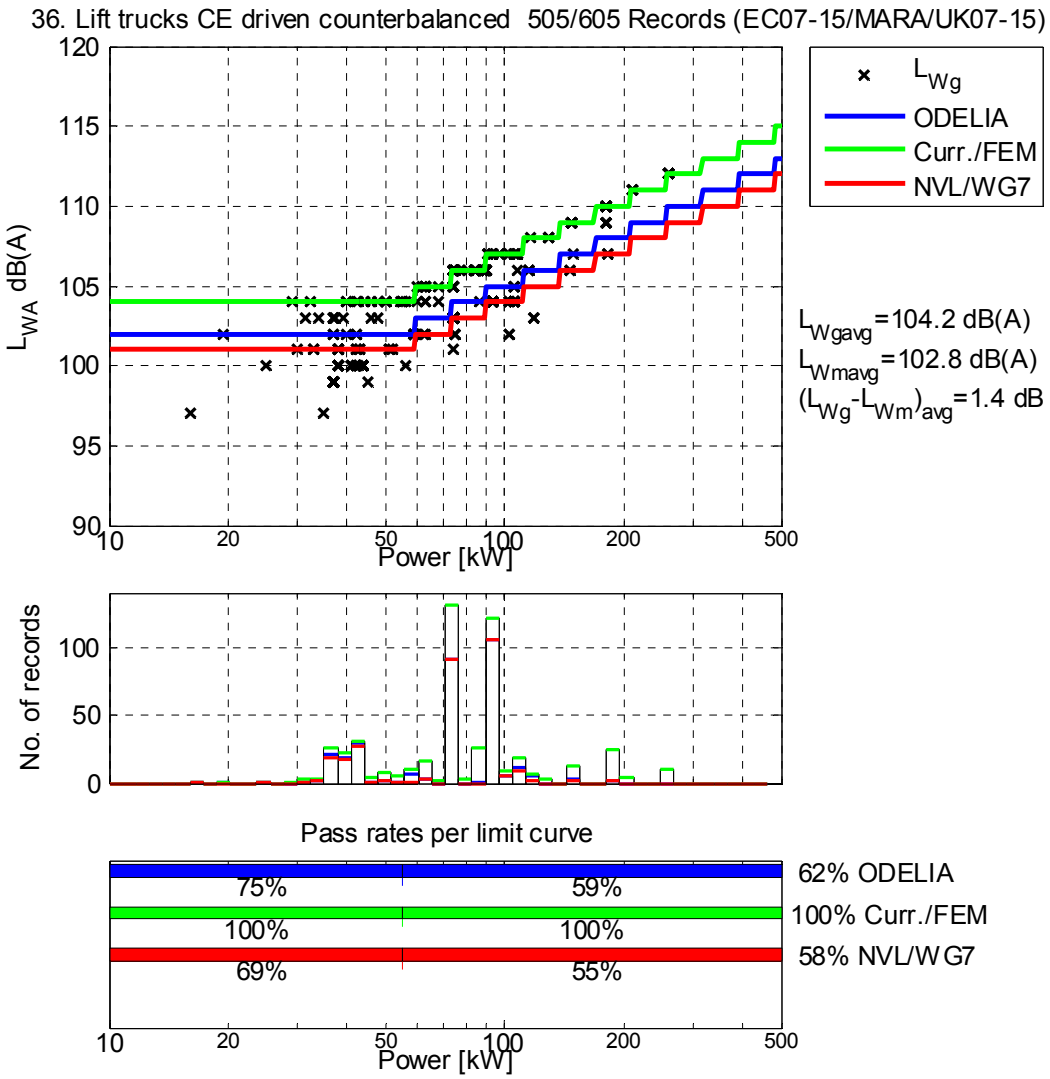
Note: Odelia is the same as WG7/2.

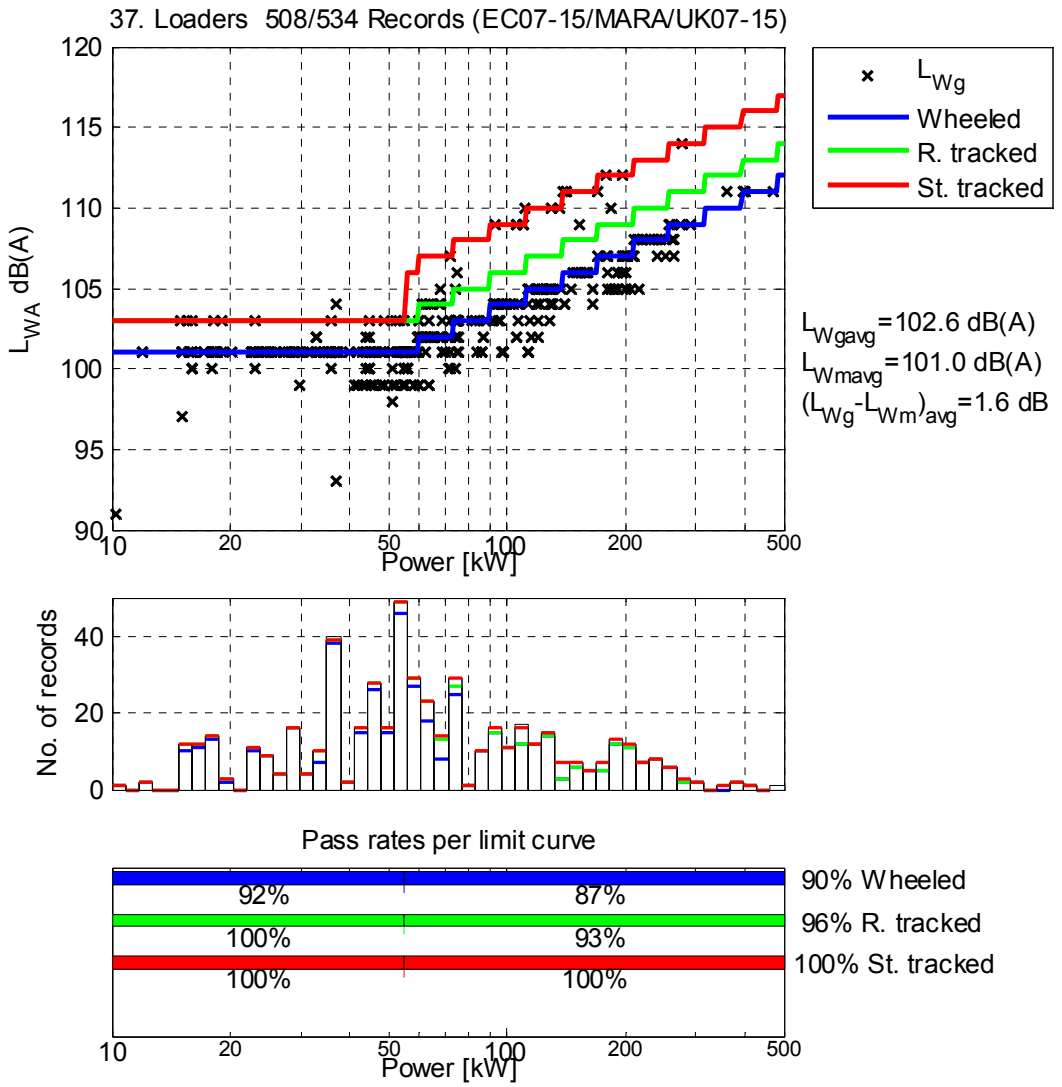

34. Leaf blowers 62/235 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA-EL
NVL-EL
WG7/2-EL
EGMF-EL
L_{Wgavg}=103.4 dB(A)
L_{Wmavg}=100.2 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.2 dB
No. of records
Pass rates per limit curve
73% ODELIA-EL
61% NVL-EL
97% WG7/2-EL
97% EGMF-EL
95%
100%

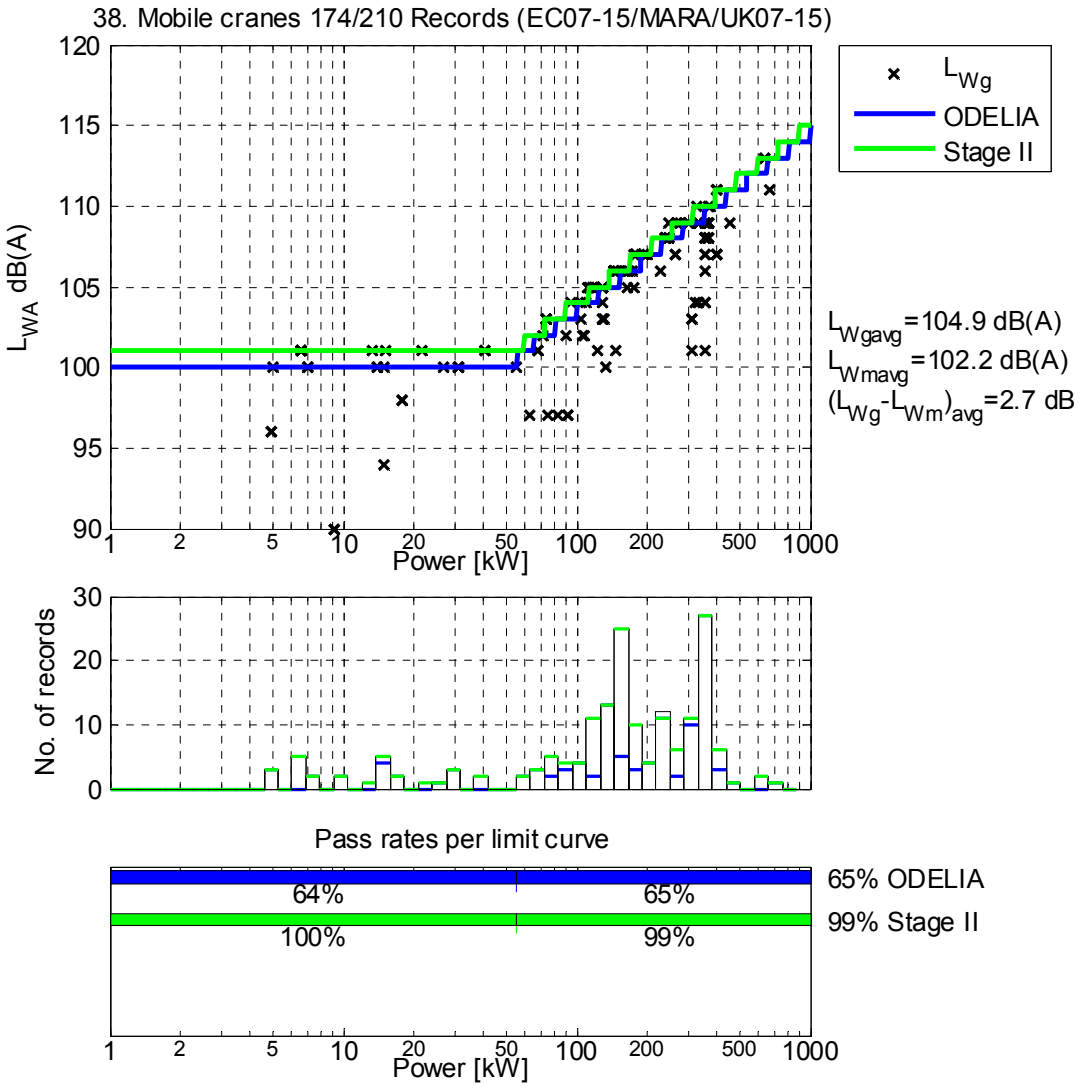


Note: Odelia is the same as WG7/2.

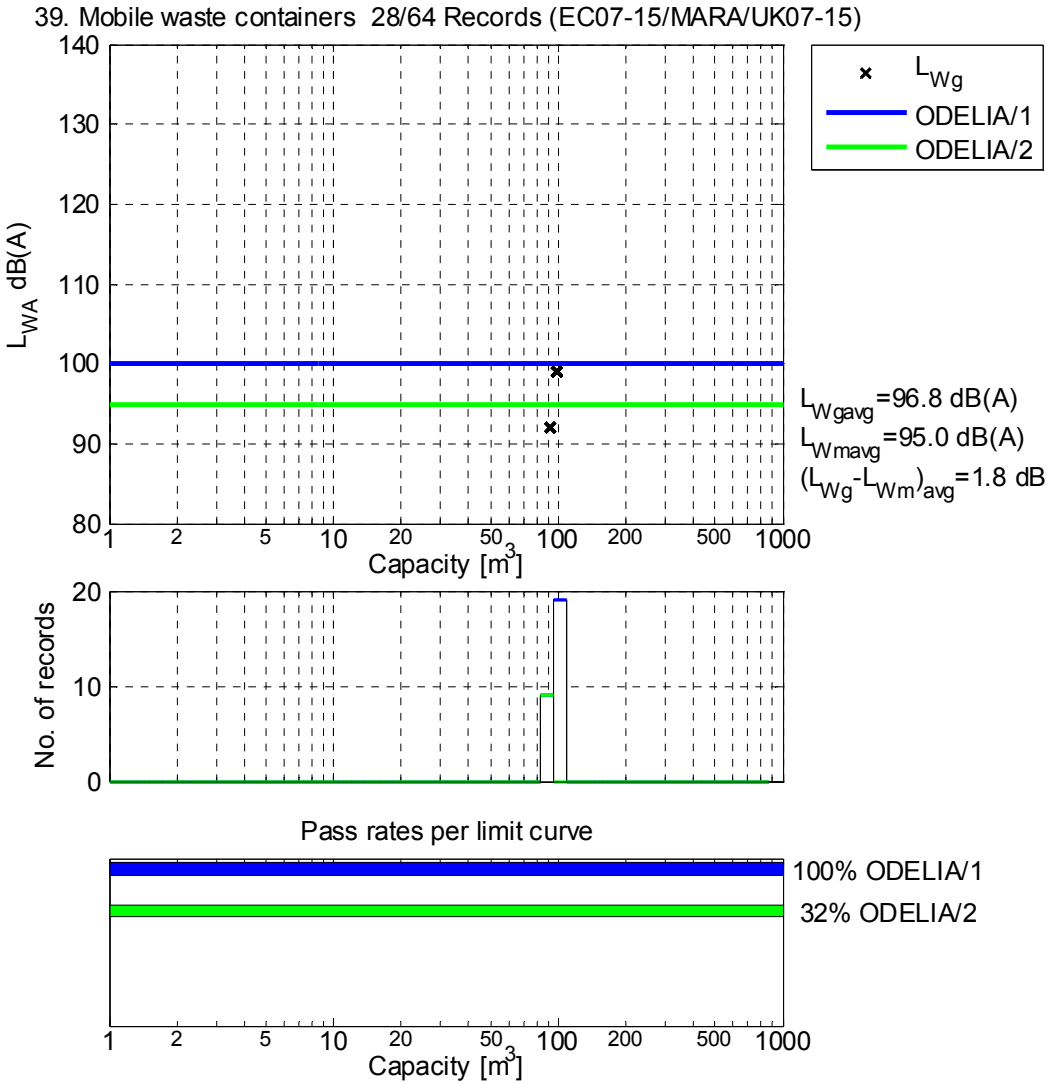

35. Leaf collectors 40/150 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA-EL
NVL-EL
WG7/2-EL
EGMF-EL
L_{Wgavg}=102.8 dB(A)
L_{Wmavg}=100.5 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.3 dB
No. of records
Pass rates per limit curve
83% ODELIA-EL
65% NVL-EL
98% WG7/2-EL
98% EGMF-EL
96%
100%


36. Lift trucks CE driven counterbalanced 505/605 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA
Curr./FEM
NVL/WG7
L_{Wgavg}=104.2 dB(A)
L_{Wmavg}=102.8 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.4 dB
No. of records
Pass rates per limit curve
75%
59%
100%
100%
69%
55%
62% ODELIA
100% Curr./FEM
58% NVL/WG7

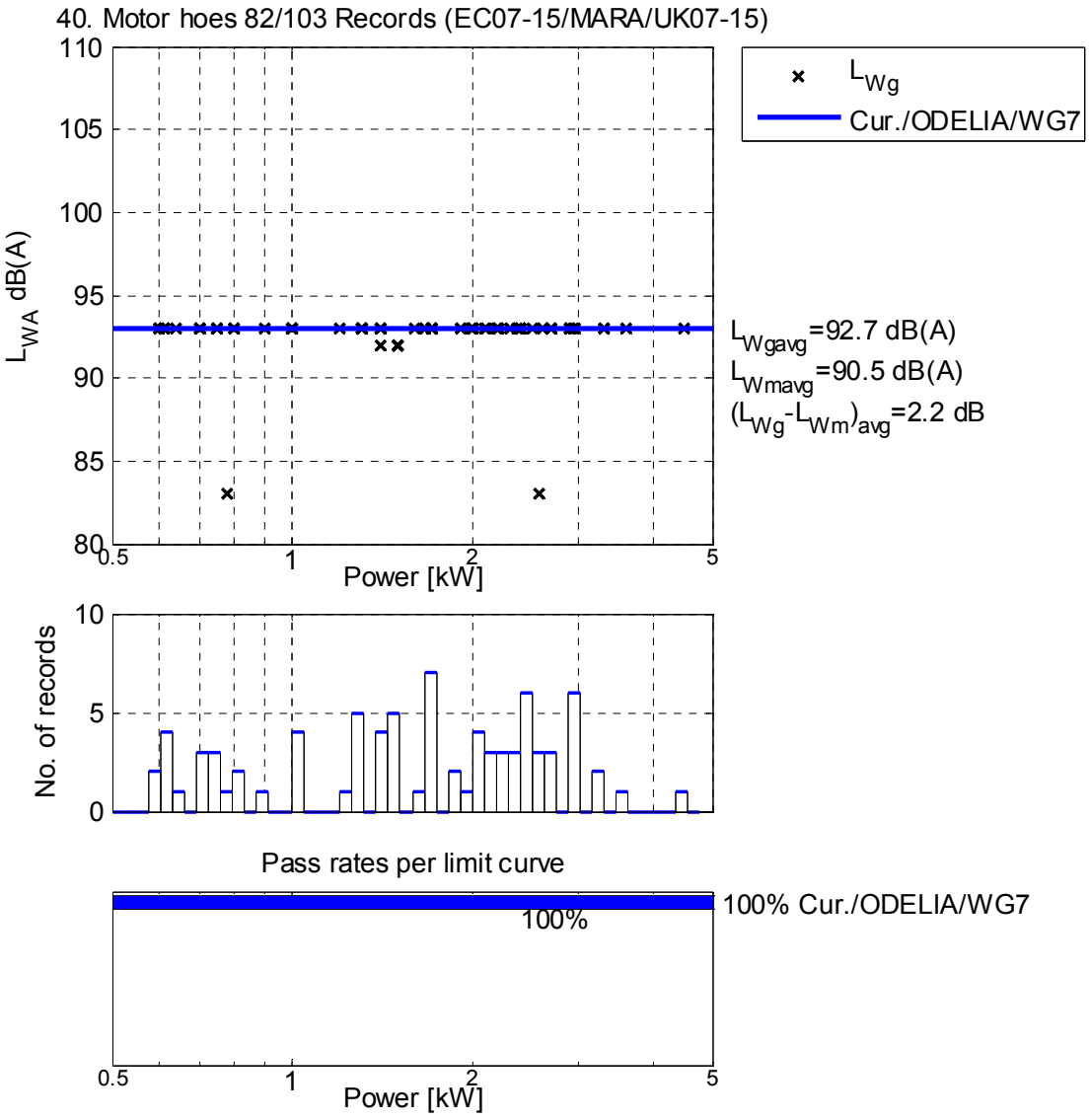

37. Loaders 508/534 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
Wheeled
R. tracked
St. tracked
L_{Wgavg}=102.6 dB(A)
L_{Wmavg}=101.0 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.6 dB
No. of records
Pass rates per limit curve
92%
87%
100%
93%
100%
100%
90% Wheeled
96% R. tracked
100% St. tracked

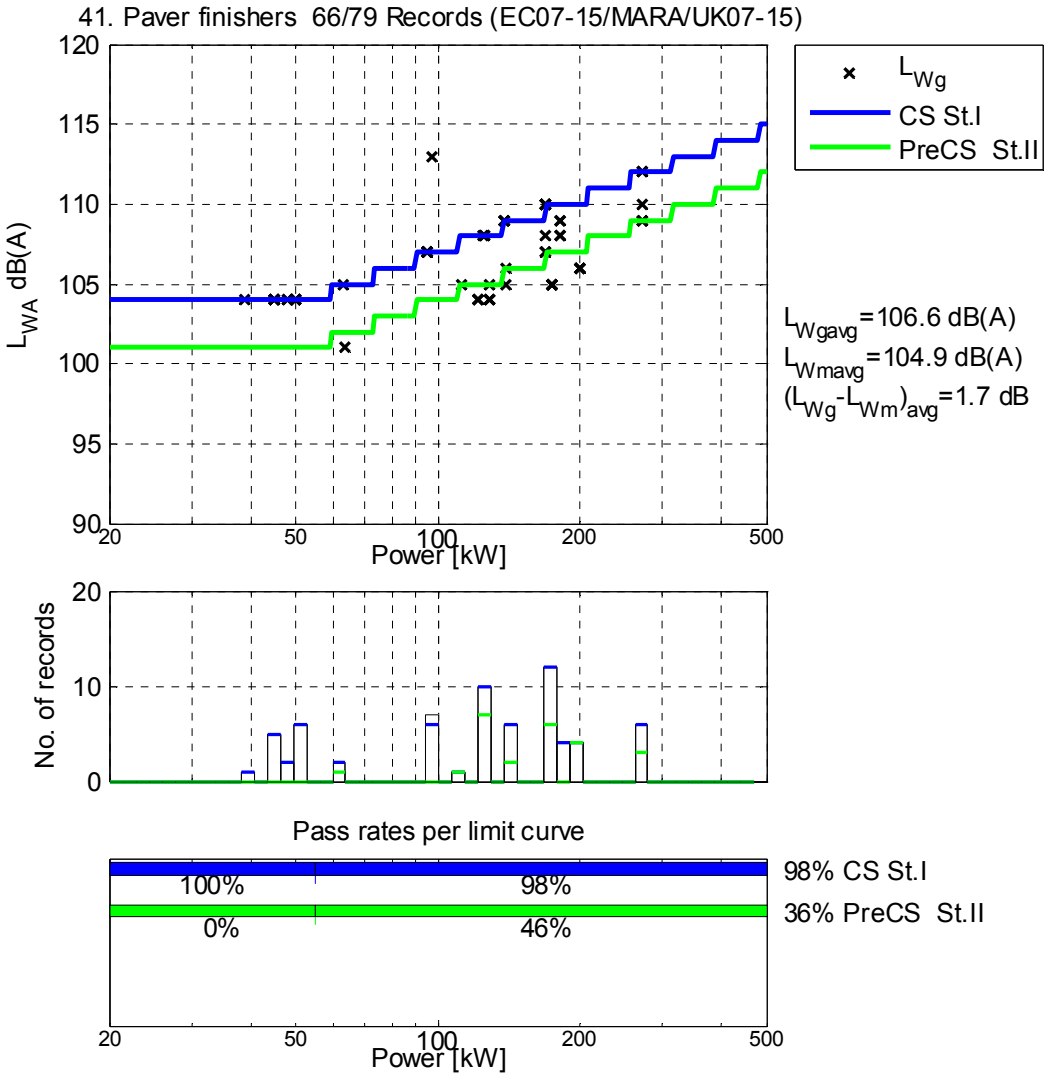


Stage II corresponds to Nomeval/WG7/FEM proposals.

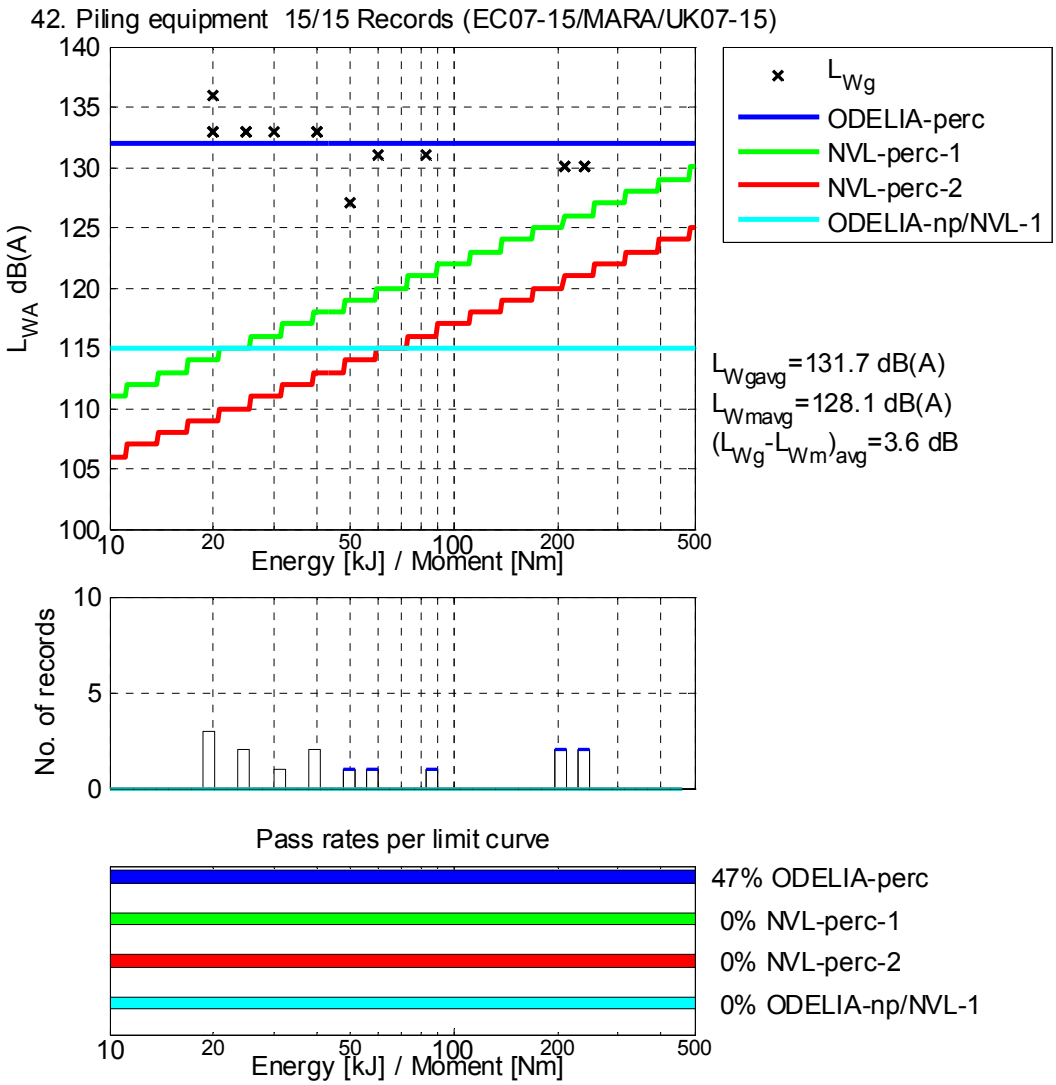


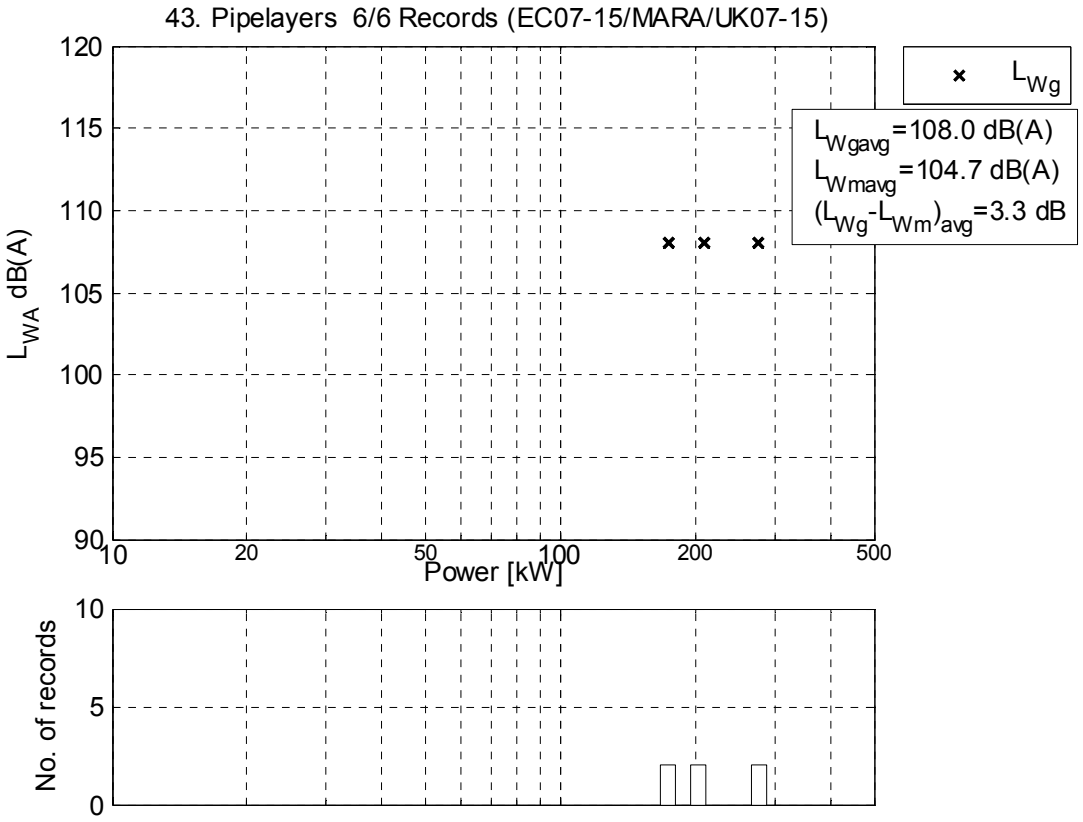
The data shown seems to have the technical parameter given in liters.
Proposals correspond to Nomeval and WG7.

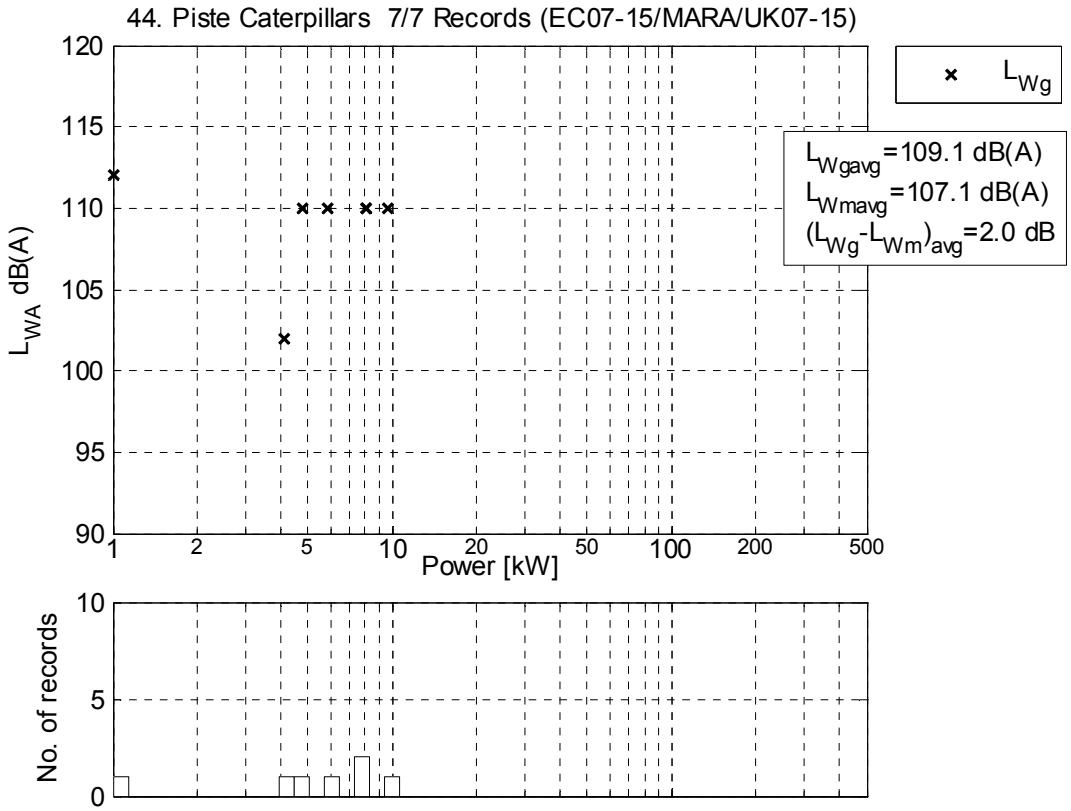

40. Motor hoes 82/103 Records (EC07-15/MARA/UK07-15)
110
105
100
95
90
85
80
L_{WA} dB(A)
0.5
1
2
5
Power [kW]
L_{Wg}
Cur./ODELIA/WG7
L_{Wgavg}=92.7 dB(A)
L_{Wmavg}=90.5 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.2 dB
10
5
0
No. of records
Pass rates per limit curve
100%
100% Cur./ODELIA/WG7
0.5
1
2
5
Power [kW]

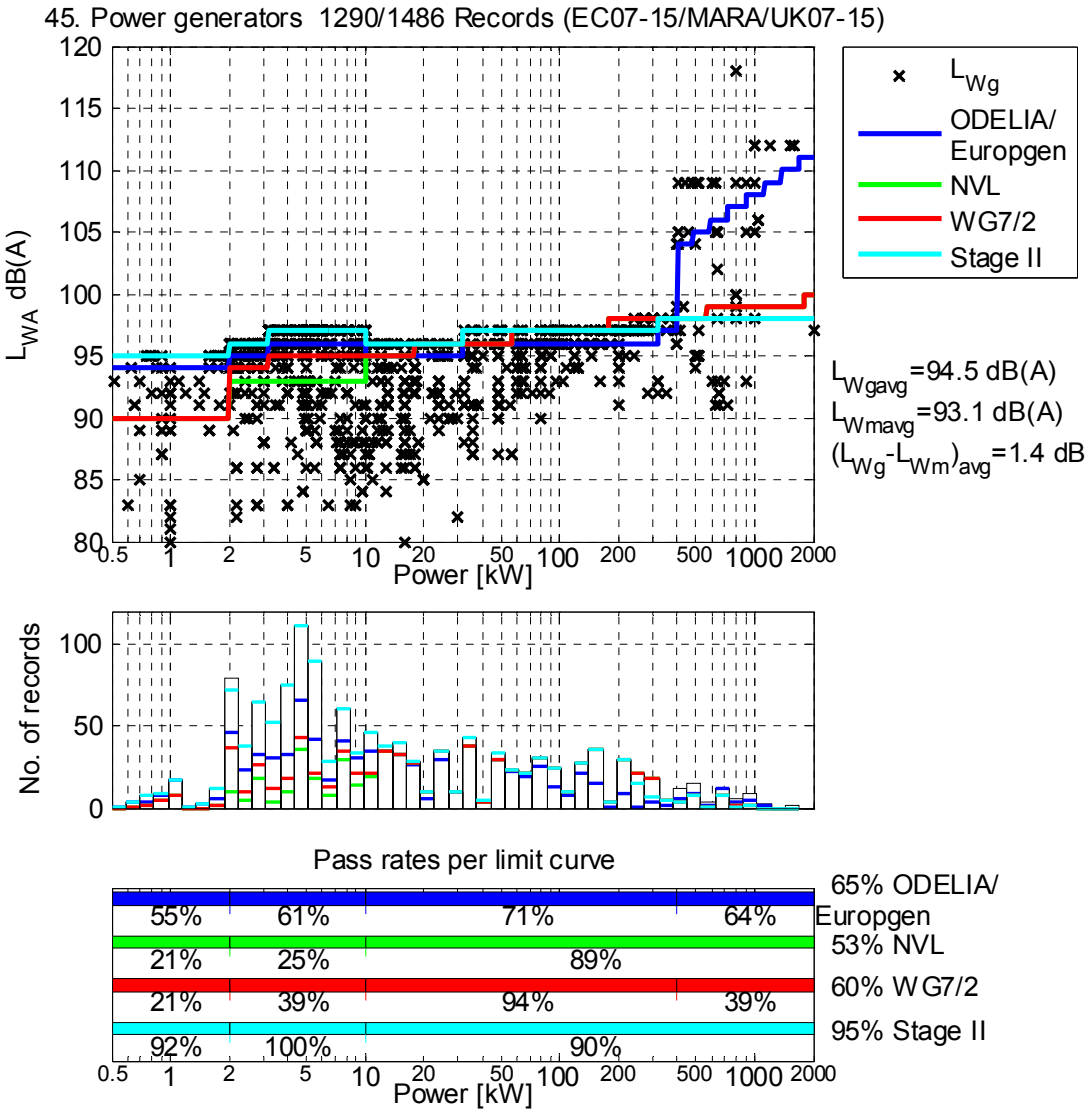


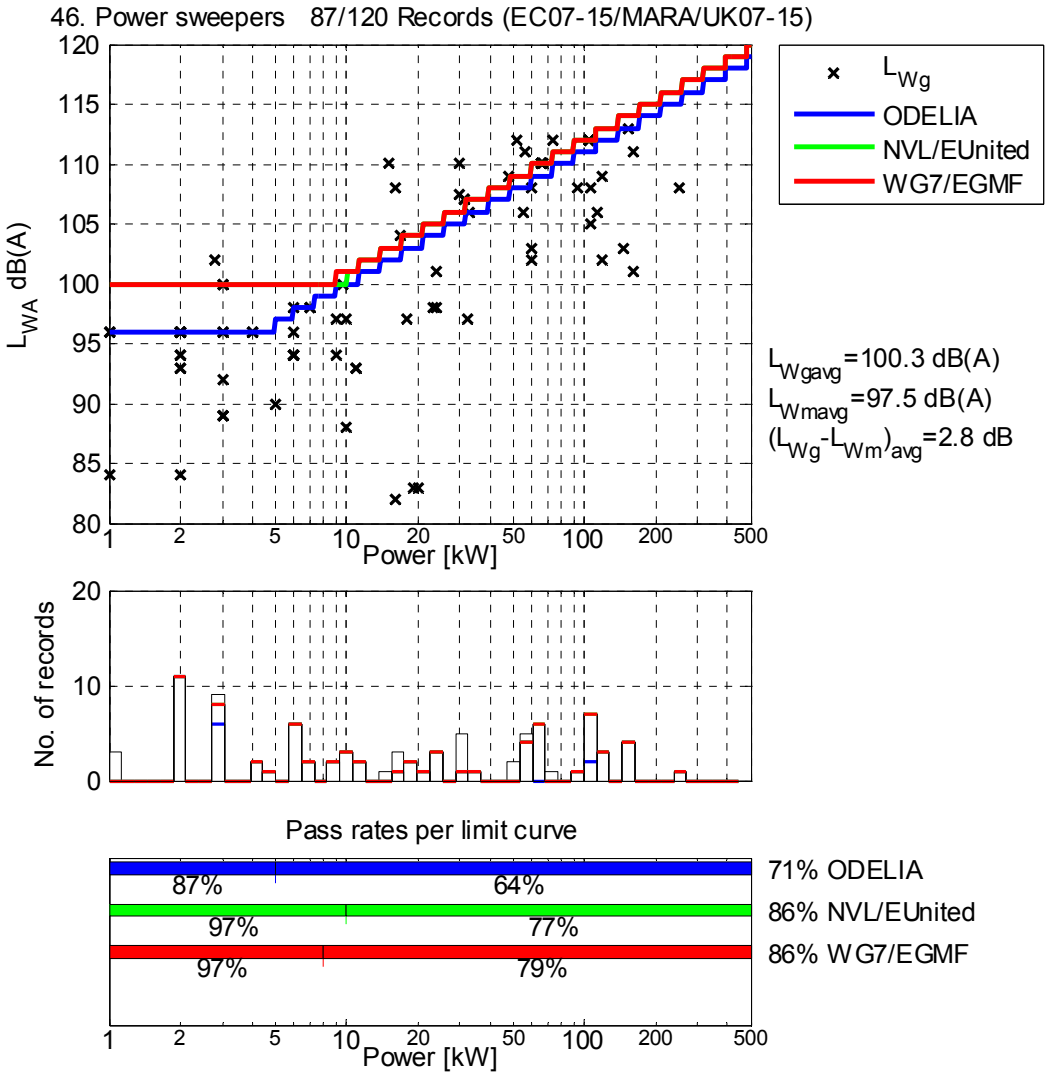
Note: No data separation between compacting and and precompacting screed equipment, so the pass rate for precompacting equipment is in fact much higher.

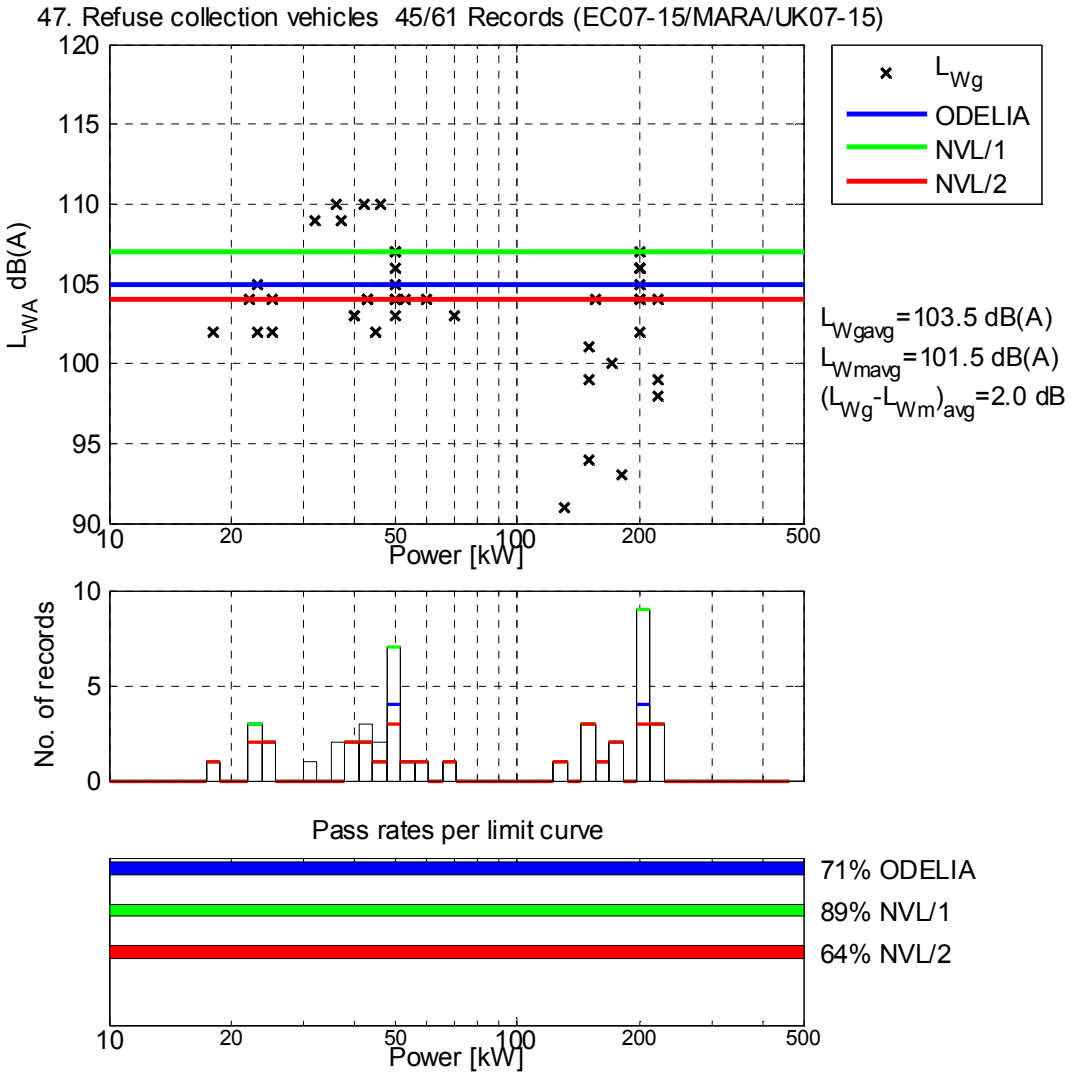

42. Piling equipment 15/15 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Energy [kJ] / Moment [Nm]
L_{Wg}
ODELIA-perc
NVL-perc-1
NVL-perc-2
ODELIA-np/NVL-1
L_{Wgavg}=131.7 dB(A)
L_{Wmavg}=128.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.6 dB
No. of records
Pass rates per limit curve
47% ODELIA-perc
0% NVL-perc-1
0% NVL-perc-2
0% ODELIA-np/NVL-1
Energy [kJ] / Moment [Nm]

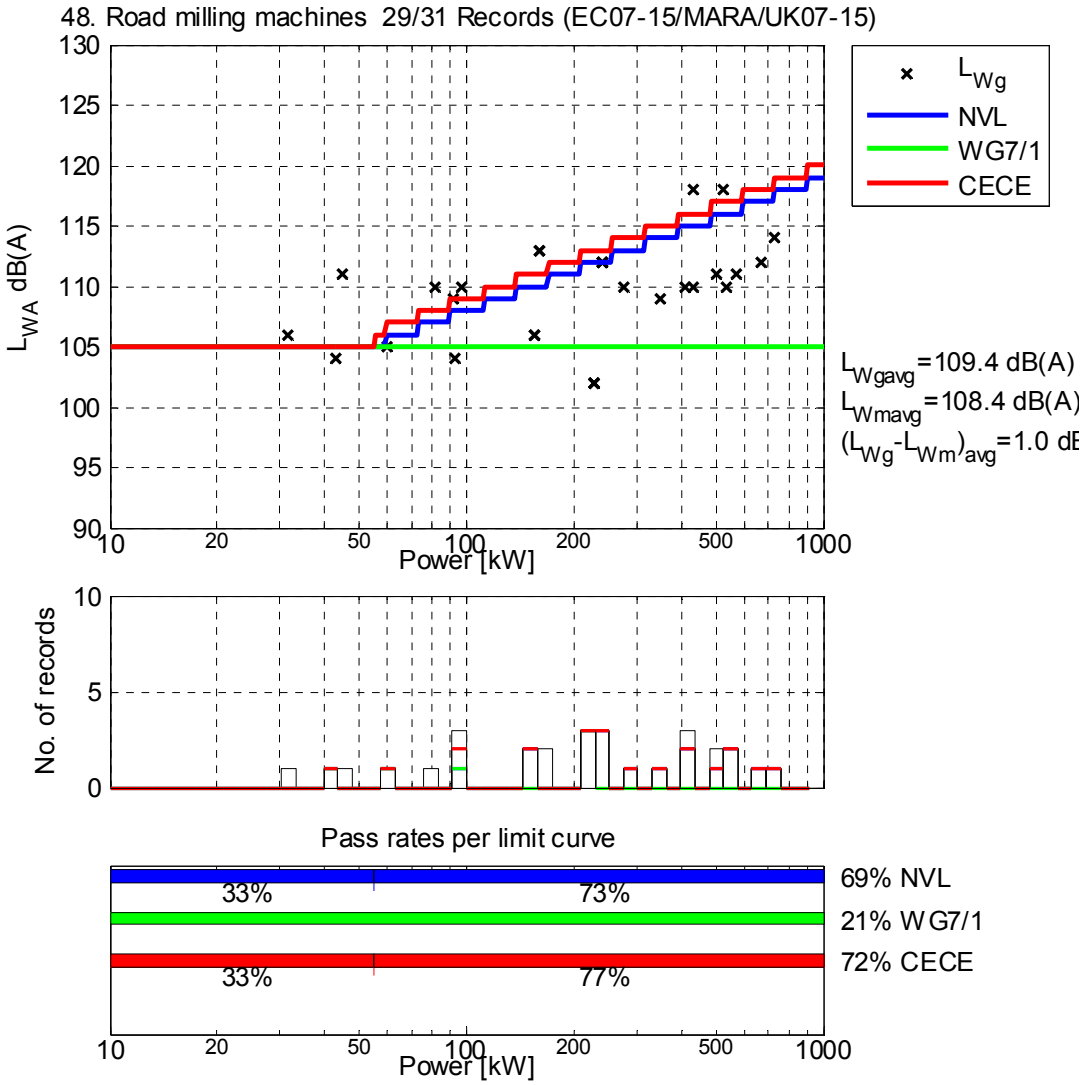

43. Pipelayers 6/6 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
No. of records
L_{Wg}
L_{Wgavg}=108.0 dB(A)
L_{Wmavg}=104.7 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.3 dB

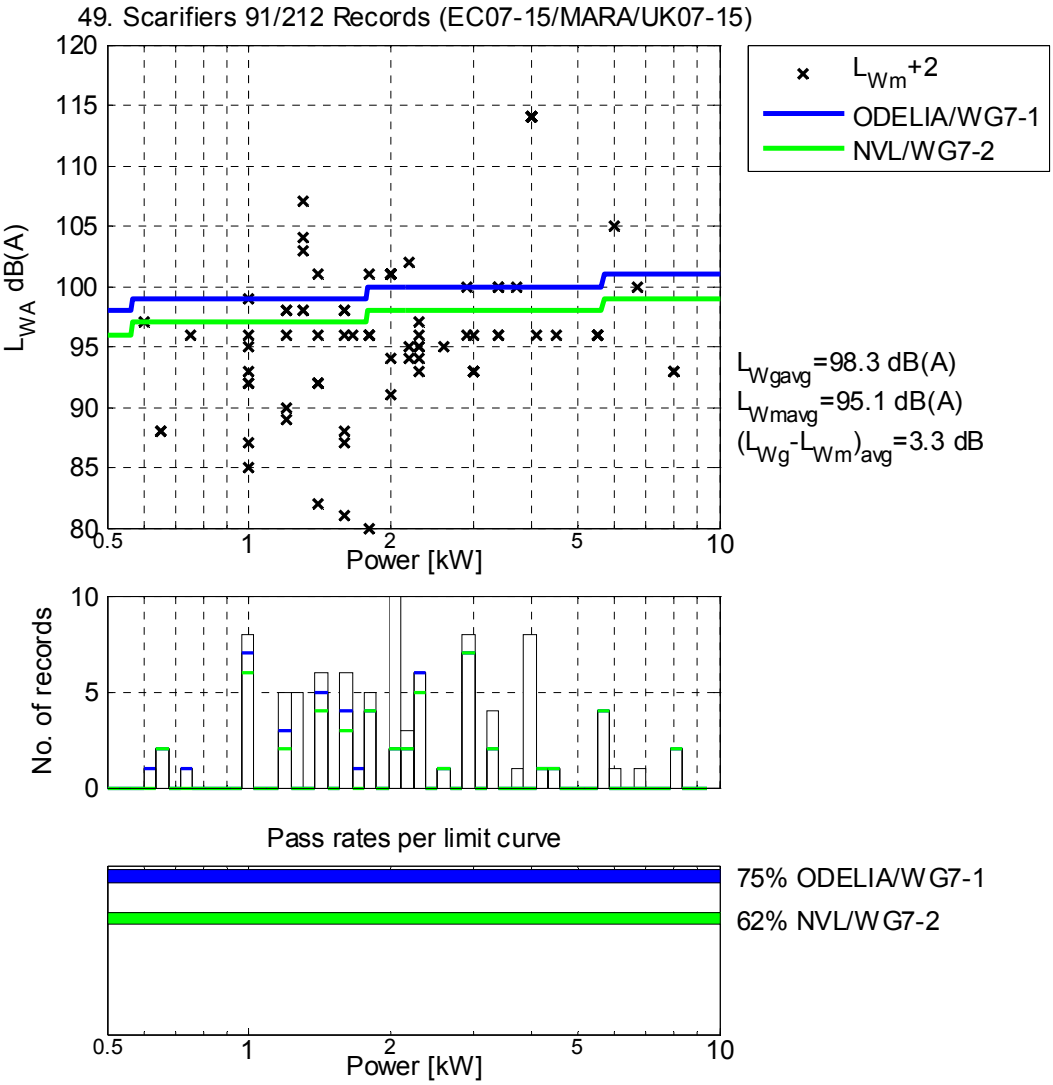

44. Piste Caterpillars 7/7 Records (EC07-15/MARA/UK07-15)
L_{Wg}
L_{Wgavg}=109.1 dB(A)
L_{Wmavg}=107.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.0 dB
L_{WA} dB(A)
Power [kW]
No. of records

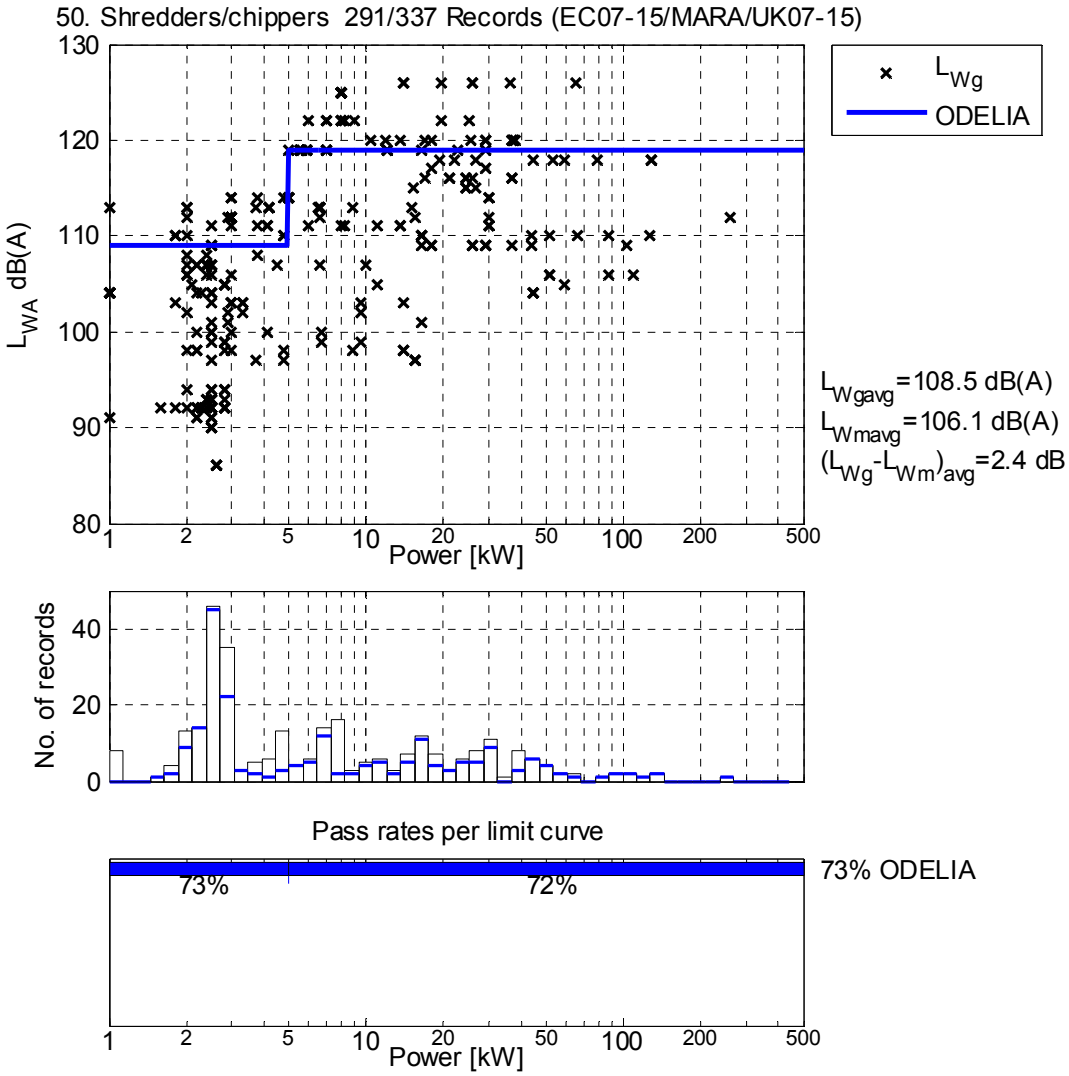

45. Power generators 1290/1486 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA/ Europgen
NVL
WG7/2
Stage II
L_{Wgavg}=94.5 dB(A)
L_{Wmavg}=93.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.4 dB
No. of records
Pass rates per limit curve
55% 61% 71% 64%
65% ODELIA/ Europgen
21% 25% 89%
53% NVL
21% 39% 94% 39%
60% WG7/2
92% 100% 90%
95% Stage II


46. Power sweepers 87/120 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA
NVL/EUnited
WG7/EGMF
L_{Wgavg}=100.3 dB(A)
L_{Wmavg}=97.5 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.8 dB
No. of records
Pass rates per limit curve
87%
64%
97%
77%
97%
79%
71% ODELIA
86% NVL/EUnited
86% WG7/EGMF

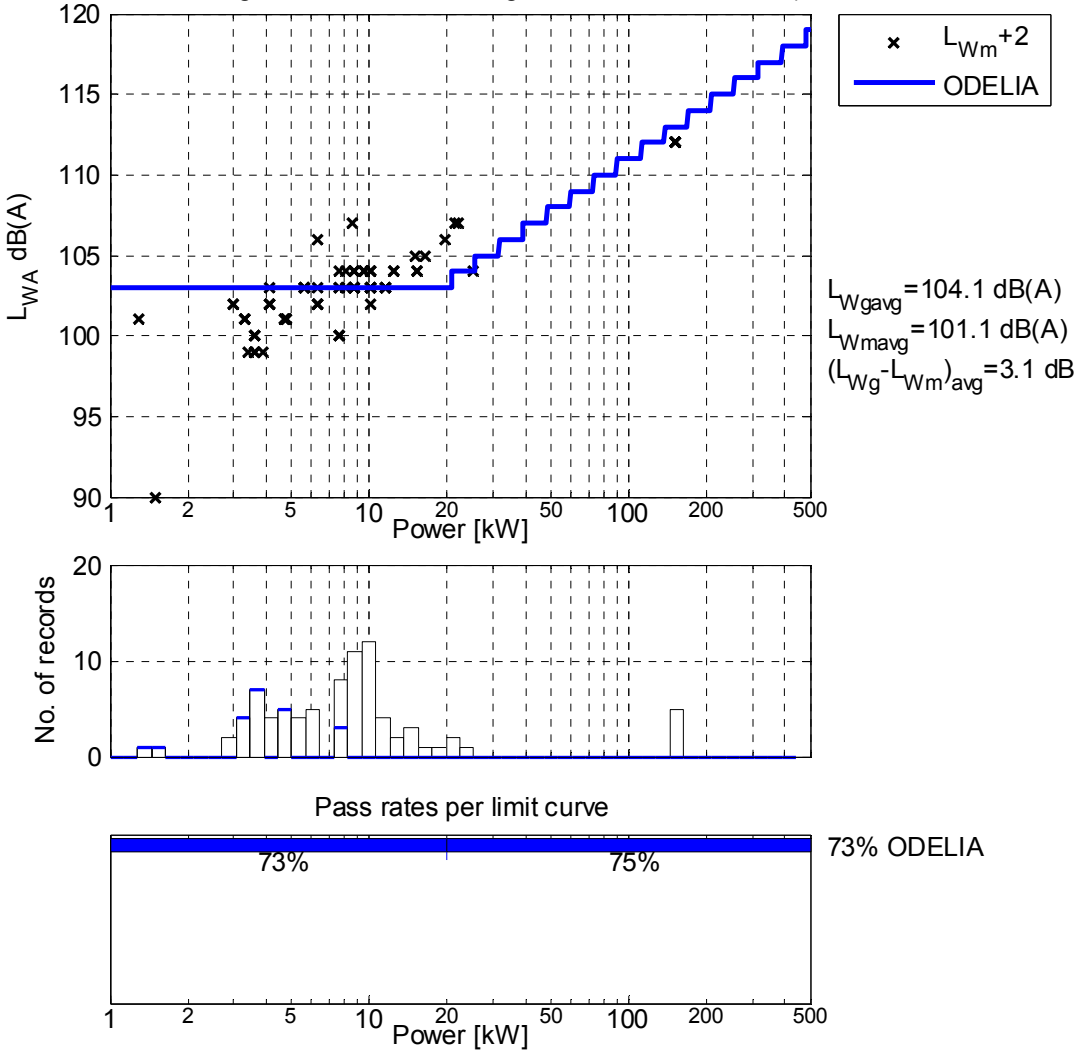

47. Refuse collection vehicles 45/61 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA
NVL/1
NVL/2
L_{Wgavg}=103.5 dB(A)
L_{Wmavg}=101.5 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.0 dB
No. of records
Pass rates per limit curve
71% ODELIA
89% NVL/1
64% NVL/2

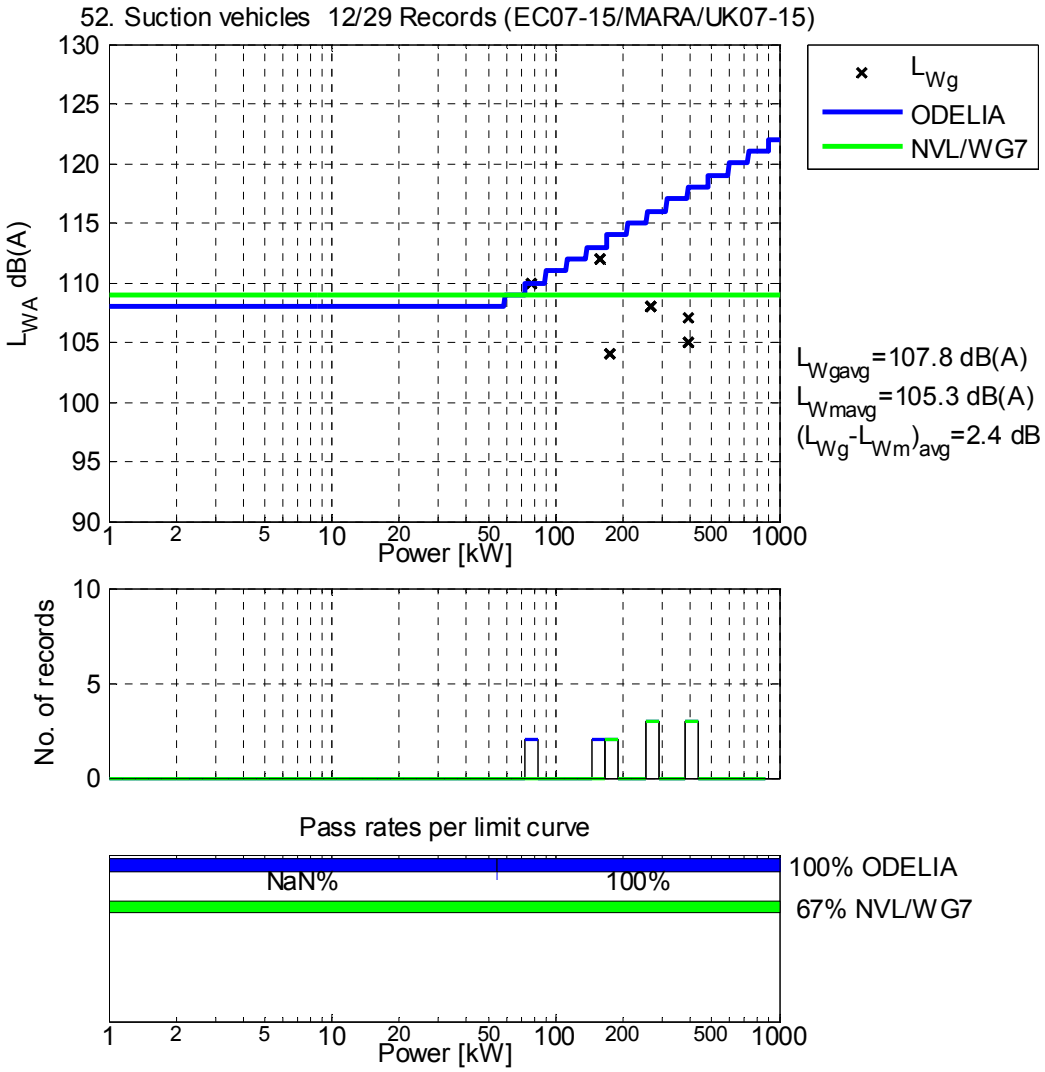

48. Road milling machines 29/31 Records (EC07-15/MARA/UK07-15)
130
125
120
115
110
105
100
95
90
L_{WA} dB(A)
10
20
50
100
200
500
1000
Power [kW]
L_{Wg}
NVL
WG7/1
CECE
L_{Wgavg}=109.4 dB(A)
L_{Wmavg}=108.4 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=1.0 dB
No. of records
10
5
0
Pass rates per limit curve
33%
73%
33%
77%
69% NVL
21% WG7/1
72% CECE
10
20
50
100
200
500
1000
Power [kW]

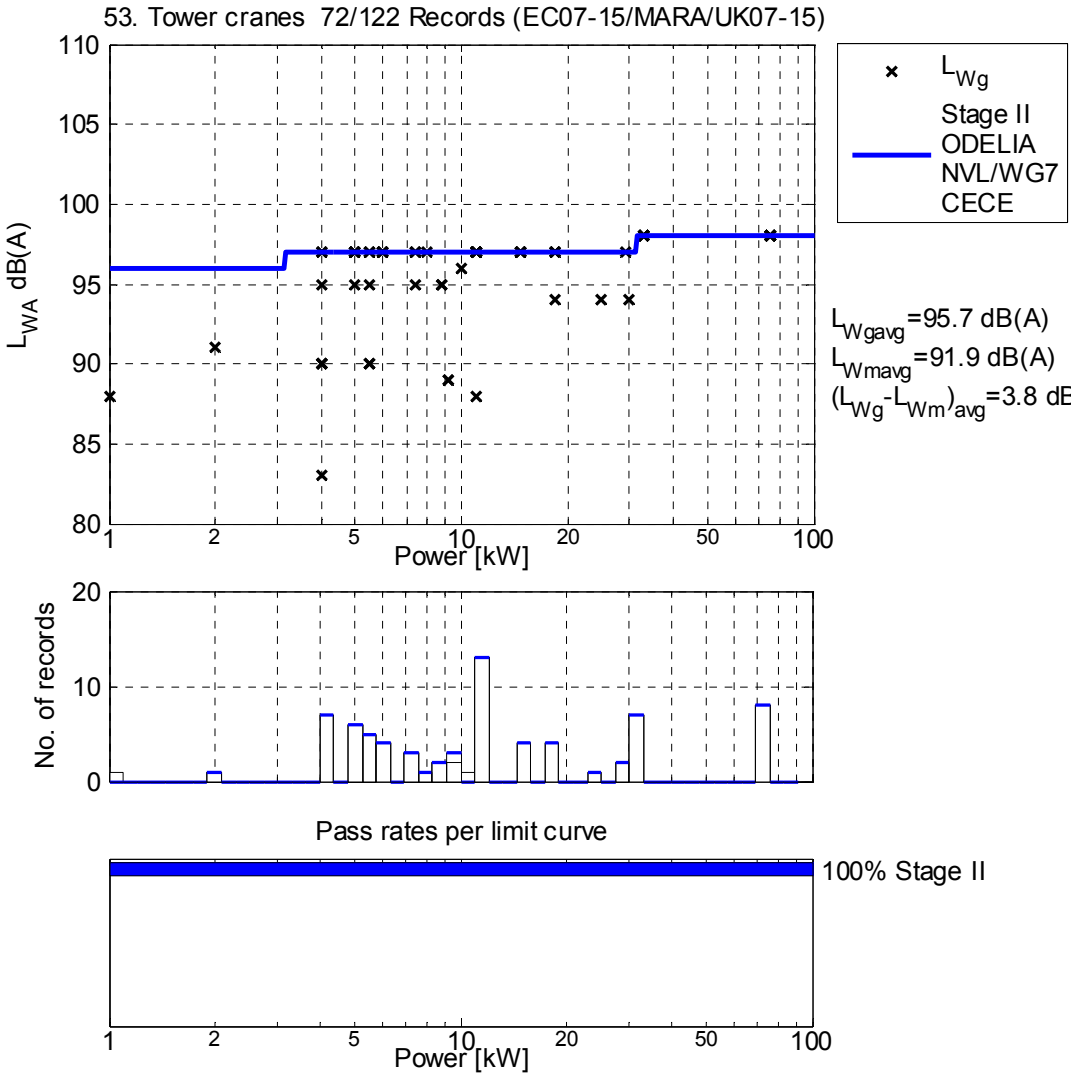

49. Scarifiers 91/212 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wm}+2
ODELIA/WG7-1
NVL/WG7-2
L_{Wgavg}=98.3 dB(A)
L_{Wmavg}=95.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.3 dB
No. of records
Pass rates per limit curve
75% ODELIA/WG7-1
62% NVL/WG7-2

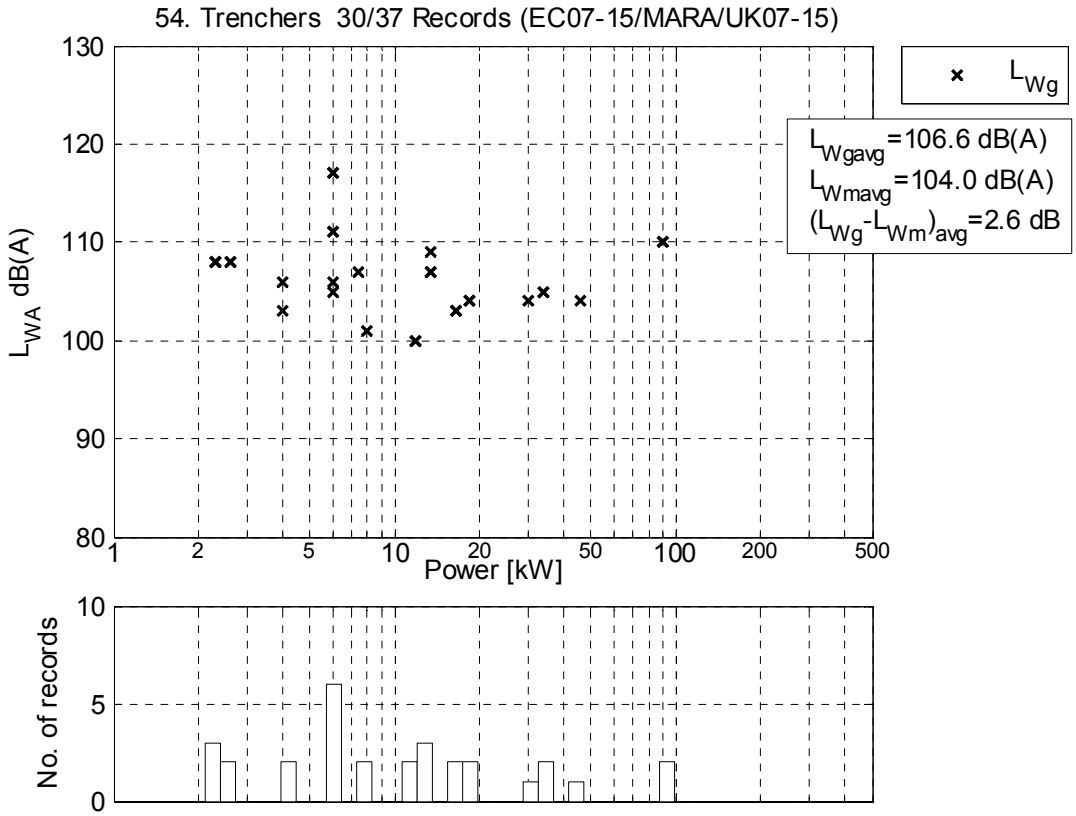

50. Shredders/chippers 291/337 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
130
120
110
100
90
80
1
2
5
10
20
50
100
200
500
Power [kW]
L_{Wg}
ODELIA
L_{Wgavg}=108.5 dB(A)
L_{Wmavg}=106.1 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.4 dB
No. of records
40
20
0
Pass rates per limit curve
73%
72%
73% ODELIA
1
2
5
10
20
50
100
200
500
Power [kW]

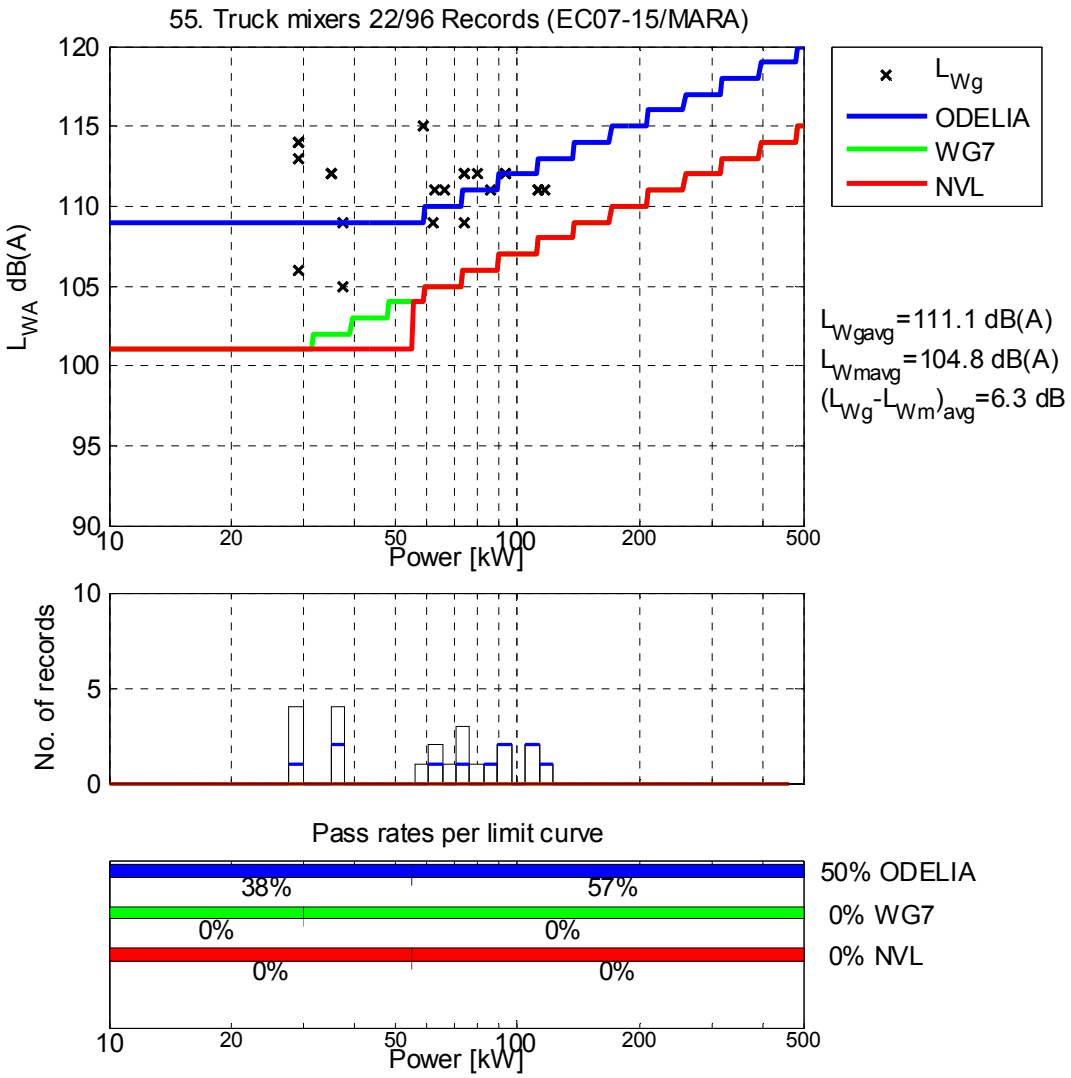
51. Snow-removing machines with rotating tools 83/139 Records (EC07-15/MARA/UK07-1

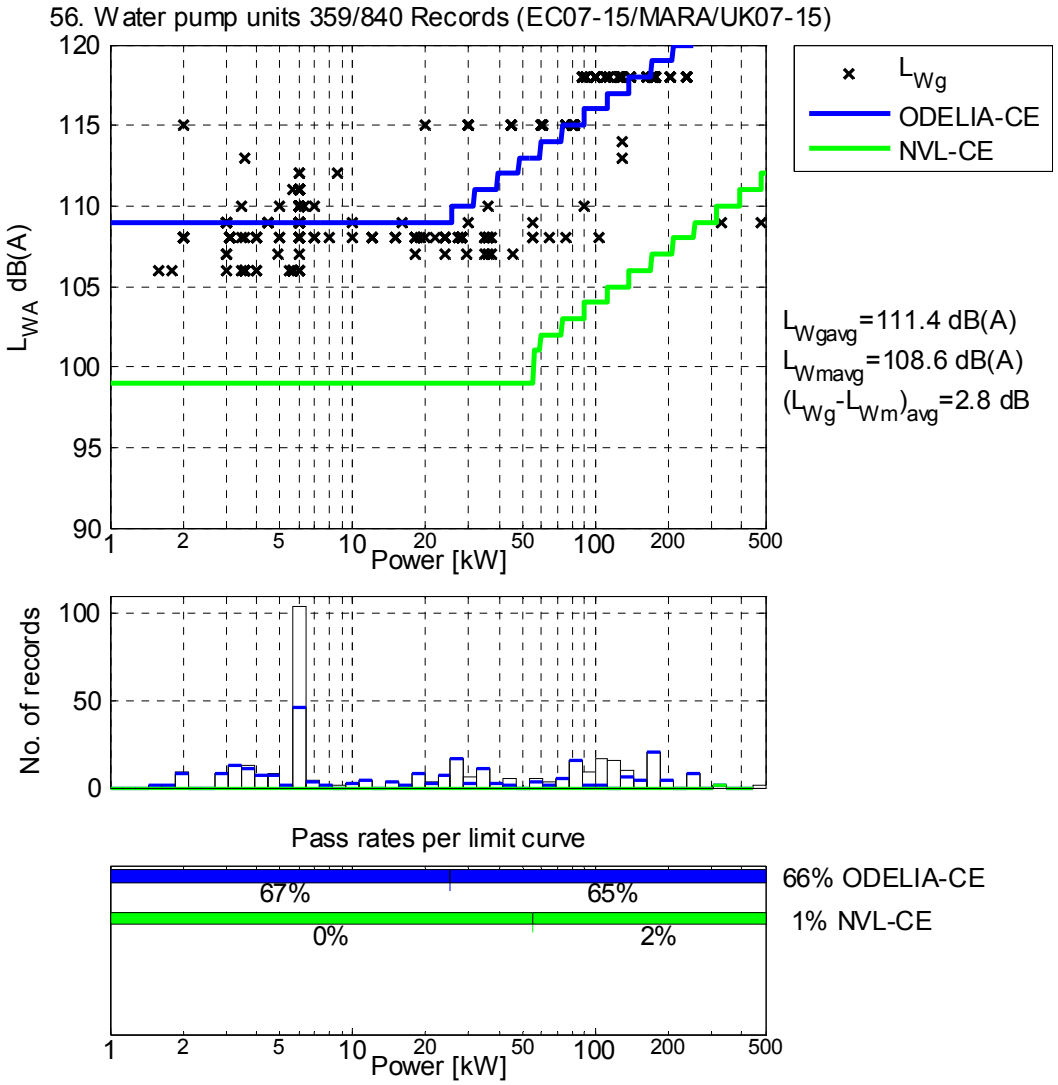


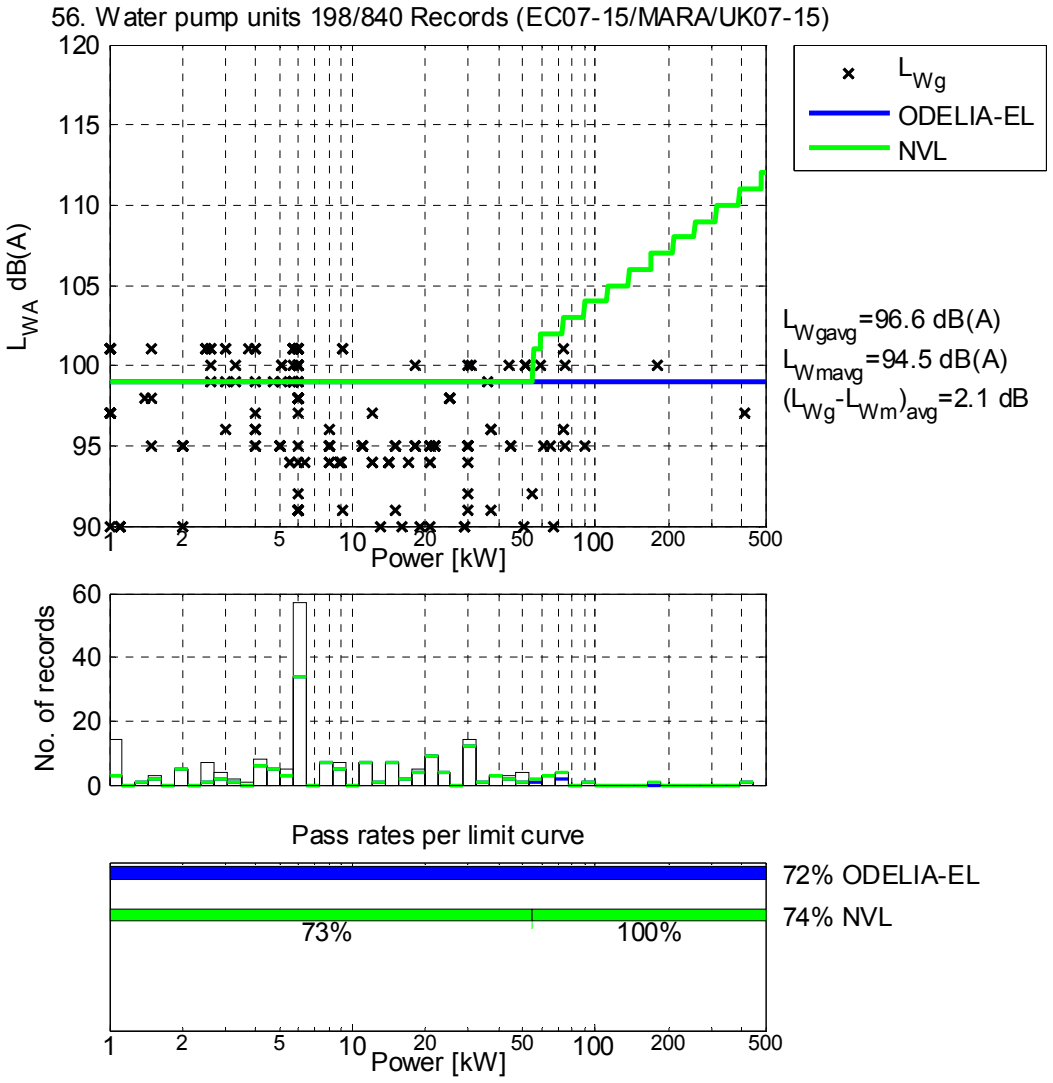

52. Suction vehicles 12/29 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
130
125
120
115
110
105
100
95
90
1
2
5
10
20
50
100
200
500
1000
Power [kW]
L_{Wg}
ODELIA
NVL/WG7
L_{Wgavg}=107.8 dB(A)
L_{Wmavg}=105.3 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.4 dB
No. of records
10
5
0
Pass rates per limit curve
NaN%
100%
100% ODELIA
67% NVL/WG7
Power [kW]


53. Tower cranes 72/122 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
Stage II
ODELIA
NVL/WG7
CECE
L_{Wgavg}=95.7 dB(A)
L_{Wmavg}=91.9 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=3.8 dE
No. of records
Pass rates per limit curve
100% Stage II
Power [kW]

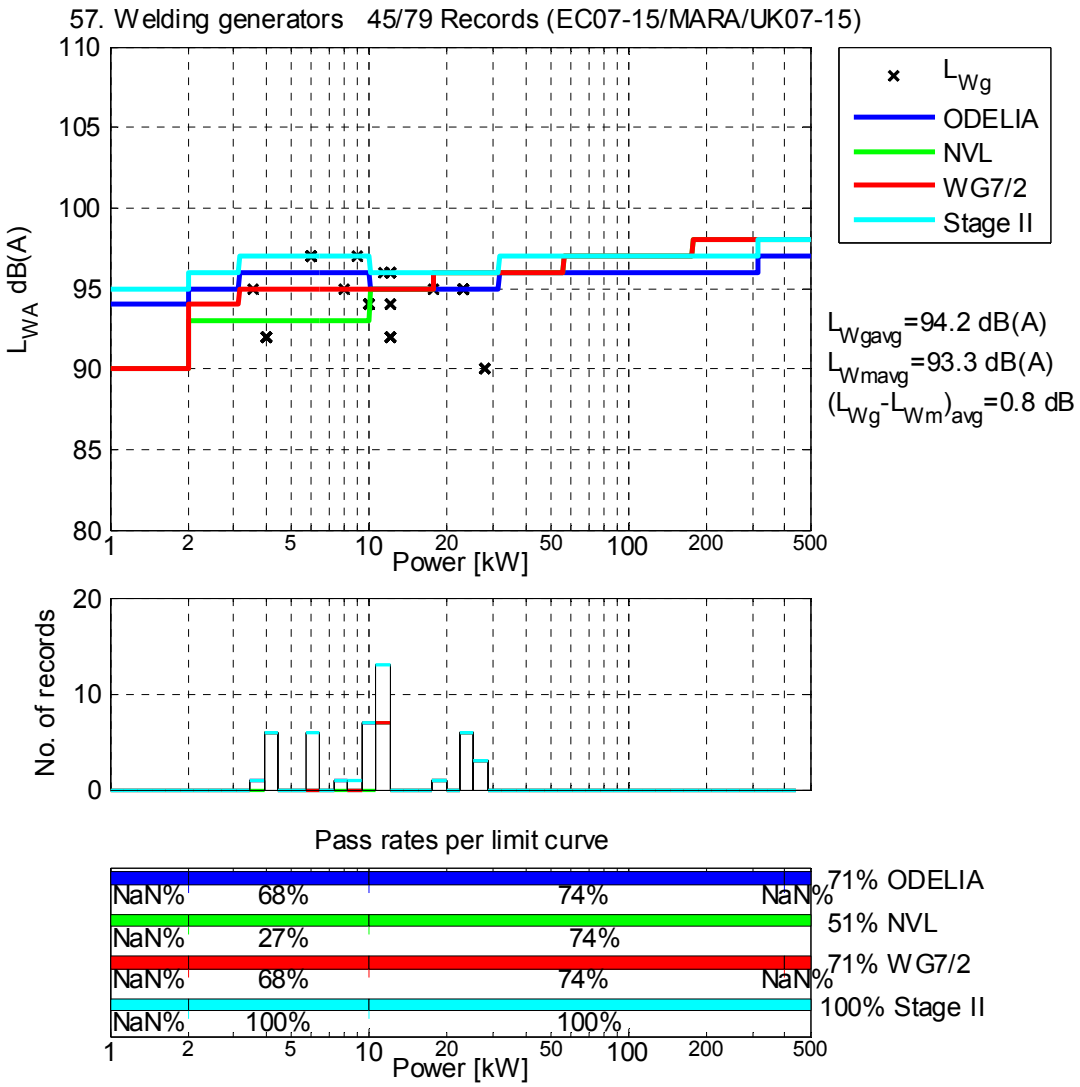

54. Trenchers 30/37 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
130
120
110
100
90
80
1
2
5
10
20
50
100
200
500
Power [kW]
L_{Wg}
L_{Wgavg}=106.6 dB(A)
L_{Wmavg}=104.0 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.6 dB
No. of records
10
5
0


55. Truck mixers 22/96 Records (EC07-15/MARA)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA
WG7
NVL
L_{Wgavg}=111.1 dB(A)
L_{Wmavg}=104.8 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=6.3 dB
No. of records
Pass rates per limit curve
38%
57%
0%
0%
0%
0%
50% ODELIA
0% WG7
0% NVL


56. Water pump units 359/840 Records (EC07-15/MARA/UK07-15)
L_{WA} dB(A)
Power [kW]
L_{Wg}
ODELIA-CE
NVL-CE
L_{Wgavg}=111.4 dB(A)
L_{Wmavg}=108.6 dB(A)
$(L_{Wg}-L_{Wm})_{avg}$=2.8 dB
No. of records
Pass rates per limit curve
67%
65%
0%
2%
66% ODELIA-CE
1% NVL-CE
CE-powered



Electrically powered

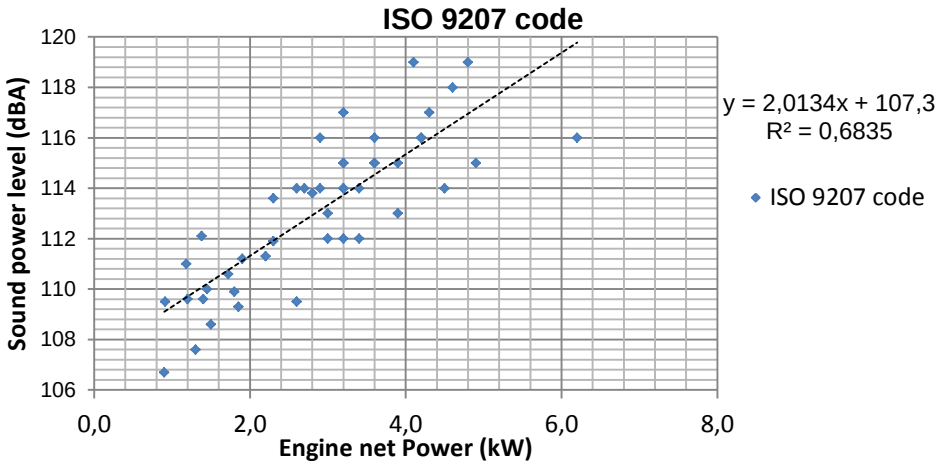

57. Welding generators 45/79 Records (EC07-15/MARA/UK07-15)
L_WA dB(A)
Power [kW]
L_Wg
ODELIA
NVL
WG7/2
Stage II
L_Wgavg=94.2 dB(A)
L_Wmavg=93.3 dB(A)
(L_Wg-L_Wm)_avg=0.8 dB
No. of records
Pass rates per limit curve
NaN% 68% 74% NaN% 71% ODELIA
NaN% 27% 74% 51% NVL
NaN% 68% 74% NaN% 71% WG7/2
NaN% 100% 100% 100% Stage II

D Data analysis of Notified Bodies

Sound power data

ICE Chain saws (ID 6a): NBs considerations

The graph below includes forty six A-weighted sound power levels measured according to ISO 9207 test code, coming from different manufacturers. These data were sent to the officer in the European Commission responsible for the Noise Outdoor Directive in 2009 as a support for the definition of possible limits for this equipment type. In this graph the trend line and its equation can be also seen.



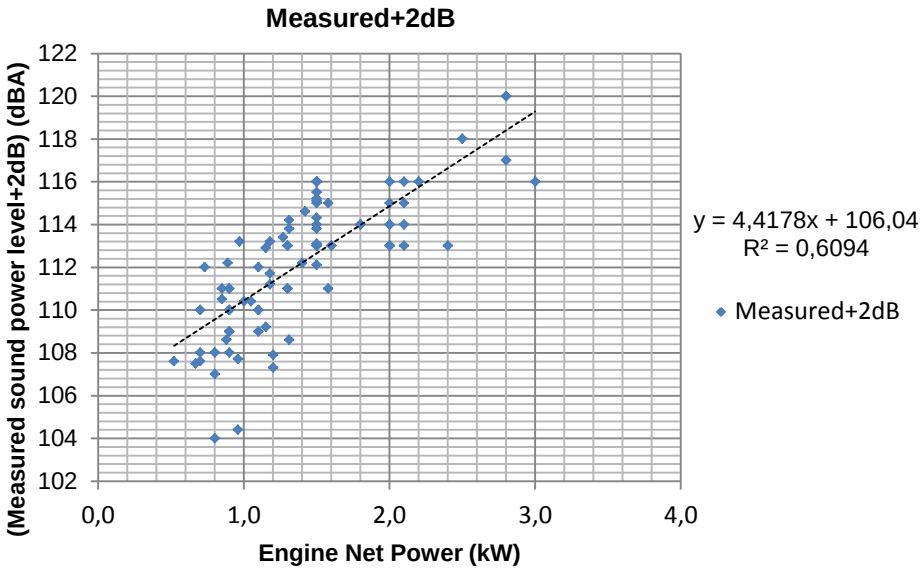
Starting from the collected data and taking into consideration:

- the analytical equation of the trend line;
- the margin of about 1.5 dB to be added in order to take into account the increase of the measured sound power levels due to the change of test code from ISO 9207 to ISO 22868 [43];
- the value of the expanded uncertainty K of about 1.8 dB (the reproducibility standard deviation value decreases with the change of test code from ISO 9207 to ISO 22868) [43];

a possible formula for noise limits could be: Lw(A) = 111 + 2 P

ICE Grass trimmers (ID 24) and brush cutters (ID 2): NBs considerations

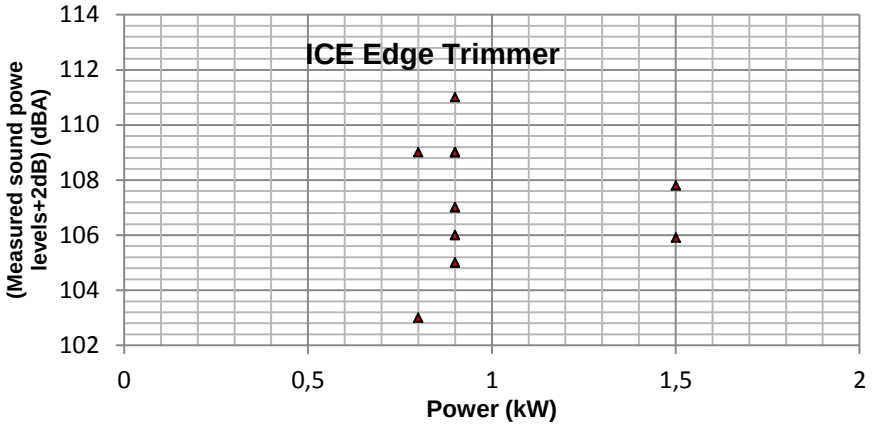
The following graph includes ninety two A-weighted sound power levels measured according to ISO 10884 test code, coming from different manufacturers. These data were sent to the officer in the European Commission responsible for the Noise Outdoor Directive in 2009 as a support for the definition of possible limits for this equipment type. This graph shows the distribution of the measured noise levels, increased of 2 dB in order to take into account the value of the expanded uncertainty K.



Taking into account the analytical equation of the trend line, a possible formula for noise limits could be: Lw(A) = 107 + 5P.
In addition, taking into account the high environmental impact of this equipment type, NBs would suggest the introduction of noise limits also for professional brush cutters and grass trimmers with mechanical power higher than 1.5 kW. These machines, are frequently used in densely populated areas.

ICE hedge trimmers (ID 25a): NBs considerations

The following graph includes the few A-weighted sound power levels measured according to ISO 11094 test code, coming from different manufacturers. These data were sent to the officer in the European Commission responsible for the Noise Outdoor Directive in 2009 as a support for the definition of possible limits for this equipment type. This graph shows the distribution of the measured noise levels, increased of 2 dB in order to take into account the value of the expanded uncertainty K.



A wide range of noise data is observed despite a quite limited difference in the engine power of the measured equipment models.

E MIA/VAMIL limits and database

The Dutch MIA/VAMIL regulation incentivises quieter outdoor equipment by allowing tax relief on purchase of equipment that is a few dB quieter than the EU limits.

For this purpose a database is used to evaluate technical progress and adjust the eligibility list each year. The equipment list for 2014 and applicable limits are set out in table E1. Analysis of the database and resulting proposals for new limits is set out in table E2.

Table E1: MIA/VAMIL list 2014, with limits for equipment that qualifies for tax relief.

Mobile machine	**Sound power level in dB (A)**
Lawnmower with L ≤ 120 cm	71+15lgL
Lawnmower with L > 120 cm	73+15lgL
Excavator with P ≤ 15 kW	82+9lgP
Excavator with P > 15 kW	82+9lgP
Shredder/chipper with input diameter > 50 mm and ≤ 200 mm	109
Shredder/chipper with input diameter > 200 mm	86+11lgP
Refuse vehicle	104
(Articulated) dumper with P ≤ 55 kW	100
(Articulated)dumper with P > 55 kW	80+11lgP
Loader with P ≤ 66 kW	98
Loader with P > 66 kW	79+11lgP
Mobile crane (including telescopic cranes) with P ≤ 55 kW	99
Mobile crane (including telescopic cranes) with P > 55 kW	79+10lgP
Water pump with P ≤ 35 kW	87
Water pump with P > 35 kW	70+11lgP
Mobile rubble crusher	84+11lgP
Power generator with P < 2	90
Power generator with 2 ≤ P ≤ 10 kW	93
Power generator with P > 10 kW	88+2lgP
Agricultural or forestry tractor	57+11lgP (max sound pressure level)
Sweeper (suction) machine with P ≤ 10 kW	100
Sweeper (suction) with P > 10 kW	90+11lgP
Telehandler or fork lift truck with P ≤ 55 kW	99
Telehandler or fork lift truck with P > 55kW	80+11lgP

Table E2: Potential reduction of noise limits based on MIA/VAMIL data from 2014.
Levels in bold print are potential limit changes.

Type	Power range	Current limit or Nomeval proposal	Potential limit based on >90% compliance	Potential limit based on >75% compliance	Based on number of samples	Last WG7 proposal
Excavator	P ≤ 15 kW	93	93	93	10	93
	P > 15 kW	80+11lgP	80+11lgP	**79+11lgP**	202	80+11lgP
Loader	P ≤ 66 kW	101*	101	**99**	75	101
	P > 66 kW	82+11lgP*	81+11lgP	**80+11lgP**	91	82+11lgP
Mobile crane / telescopic crane	P < 55 kW	101				101
	P > 55 kW	82+11lgP	81+11lgP	**80+11lgP**	38	82+11lgP
Water pump (curr.Art.13)	P ≤ 35 kW	99***	90	**87**	39	Art. 13.
	P > 35 kW	82+11lgP***	72+11lgP	**70+11lgP**	12	Art. 13.
Power Generator	P > 10 kW	95+lgP**	89+2lgP	**88+2lgP**	11	95+lgP

* Nomeval with power ranges P<55; P>55
** Nomeval proposal was 93+2logP
*** Nomeval proposal

Table E3: For comparison, potential sound power limit derived from measured pass-by test maximum sound pressure level L_{pAFmax} for acceleration test at 7,5 m (conversion from current sound pressure limit to maximum sound power level in brackets).

Type	Mass range	Current limit L_{pAFmax} dB(A)	Potential limit L_{WA}	Number of samples
Agricultural or forestry tractor 74/151/EG (not 2000/14)	m <=1,5 t m >1,5 t	85 89	60+11lgP 60+11lgP (85+11lgP)	207

F Information tables for each equipment type

1. Aerial access platforms with combustion engine

Definition	
Equipment consisting of a minimum of a work platform, an extending structure and a chassis. The work platform is a fenced platform or a cage which can be moved under load to the required working position. The extending structure is connected to the chassis …	
Technical description	
Technical parameter: Net installed power	***Unit:*** kW
Range: full	
Drive type: CE-diesel	
***Main noise sources*:** Engine (+exhaust+intake), fan, hydraulics	
Process noise contribution: No	
Workpiece noise contribution: No	
Environmental noise impact	
Typical areas of use: Urban/Suburban/Rural	***Typical field operation:*** Dynamic rpm
Typical usage: 10 months/year – 20 days/month – 180 minutes/day - Evening/night adj (0 to 5) = 0	
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6	
Lw_g min: 95 dB(A) **Lw_m max:**110 dB(A) **Avg. Lw_g =** 102.4 dB(A) **Avg. Lw_m =** 100 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.4 dB	
Estimated population: 91000	***Environmental impact indicator:* 52 (medium)**
Current situation	
Test code: ISO 3744:1995	
Article: 13	***Limits***: **none**
ODELIA STUDY	
Test code: ISO 3744:2011	
Article: 12	***Limits***: **104** (P≤60 kW) **87+9.3*lg P** (P>60 kW) ***Decision code:*** NEMTF4
Economic Impact	Considered small as technology is available.
Remarks on the test code	No better test code available. See chapter 8 remarks by FEM.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	CE-powered machines are being gradually replaced by electrical ones, currently estimated at 50% for boom lifts and 75% for scissor lifts. The databases show no relation with the installed power, but data may be missing.

2. Brush cutters

Definition
A combustion-engine driven portable hand-held unit fitted with a rotating blade made of metal or plastic intended to cut weeds, brush, small trees and similar vegetation. The cutting device operates in a plane approximately parallel to the ground.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-petrol 2-stroke ***Main noise sources*:** Engine (+exhaust+intake+fan), blade noise and cutting noise ***Process noise contribution:*** Can be relevant if hard materials are cut with impacts ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 5 months/year – 1 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 103 dB(A) **Lw_m max:**119 dB(A) **Avg. Lw_g =** 112.4 dB(A) **Avg. Lw_m =** 108.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.5 dB ***Estimated population***: 27000000 ***Environmental impact indicator:* 65 (high)**
Current situation
Test code: ISO 10884:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 22868:2011 ***Article:*** 12 ***Limits***: **107+5.5*P** (P≤1.5 kW) **115** (P>1.5 kW) ***Decision code:*** NETF4

Economic Impact	Small, as limit proposal is not very tight.
Remarks on the test code	Clear advantages compared to ISO 10884:1995 in terms of repeatability and reproducibility.
Remarks on the definition	
Possible combination with other equipment	Combine with 24 due to similarities.
Other Remarks	For P>1.5kW, the guaranteed levels in the EU and MARA databases show little dependence on power, even decreasing somewhat for increasing net power. Therefore a constant limit is considered appropriate for P>1.5 kW

3a. Builders' hoists for the transport of goods (combustion-engine driven)



Definition
A power-operated, temporarily installed builders' hoist intended for use by persons who are permitted to enter engineering and construction sites, serving (i) defined landing levels, having a platform ….
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤15 kW; P>15 kW ***Drive type:*** CE petrol 2 or 4 stroke, or diesel ***Main noise sources*:** Engine (+exhaust+intake) ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** High/low rpm ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 85 dB(A) **Lw_g max:**103 dB(A) **Avg. Lw_g =** 93.1 dB(A) **Avg. Lw_m =** 91.1 dB(A) **Avg. diff. Lw_g-Lw_m** = 2 dB ***Estimated population***: 52000 ***Environmental impact indicator:* 42 (low)**
Current situation
Test code: 2000/14/EC ***CE powered*** ***Article:*** 12 ***Limits***: **93** (P≤15 kW) **80+11*lg P** (P>15 kW)
ODELIA STUDY
Test code: 2000/14/EC (No change) ***CE powered*** ***Article:*** 12 ***Limits***: **93** (P≤15 kW) **80+11*lg P** (P>15 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Low numbers in database.

3b. Builders' hoists for the transport of goods (with electric motor)

Definition
A power-operated, temporarily installed builders' hoist intended for use by persons who are permitted to enter engineering and construction sites, serving (i) defined landing levels, having a platform ….
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Electric ***Main noise sources*****:** Electric motor, transmission ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 93 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 52000 ***Environmental impact indicator:*** **38 (low)**
Current situation
Test code: 2000/14/EC ***Electric*** ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Electric*** ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3
Economic Impact None as no changes occurred. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

4. Building site band saw machine

Definition
A hand-fed powered machine weighing less than 200 kg fitted with a single saw blade in the form of a continuous band mounted on and running between two or more pulleys.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Electric ***Main noise sources*:** Motor(fan), cutting and workpiece ***Process noise contribution:*** Yes ***Workpiece noise contribution:*** Yes, more relevant then for circular saws
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Normal rpm ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 110 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 26000 ***Environmental impact indicator:* 55 (medium)**
Current situation
Test code: ISO 7960:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 7960:1995 (No change) ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEM3
Economic Impact None as no changes occurred. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Insufficient data to perform statistics on the noise levels.

5. Building site circular saw bench

Definition
A hand-fed machine weighing less than 200 kg fitted with a single circular sawblade (other than a scoring saw) with a diameter of 350 mm or more, up to a maximum diameter of 500 mm, which is fixed during the normal cutting operation, and a horizontal table, …
Technical description
Technical parameter: Sawblade diameter ***Unit:*** mm ***Range:*** full ***Drive type:*** Electric ***Main noise sources*****:** Sawblade and workpiece ***Process noise contribution:*** Yes, but sawblade mostly dominant ***Workpiece noise contribution:*** Yes, but sawblade mostly dominant
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Not applicable ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 98 dB(A) **Lw_g max:**114 dB(A) **Avg. Lw_g =** 108.3 dB(A) **Avg. Lw_m =** 104.7 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.6 dB ***Estimated population***: 210000 ***Environmental impact indicator:* 64 (high)**
Current situation
Test code: ISO 7960:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 7960:1995 (No change) ***Article:*** 12 ***Limits***: **111** (full range) ***Decision code:*** NEMTF4
Economic Impact Small, as quieter sawblades are available. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Consistency with limits for other sawing machines should be observed, such as joint cutters and handheld cut-off saws.

6. Chain saws, portable (a.CE-powered, b. Electric)

Definition
A power-driven tool designed to cut wood with a saw chain and consisting of an integrated compact unit of handles, power source and cutting attachment, designed to be supported with two hands.

Technical description
Technical parameter: Net installed power/Electric power ***Unit:*** kW
Range: full
Drive type: CE and electric
***Main noise sources*:** Engine (+exhaust+intake+fan), blade, chain and cutting process
Process noise contribution: Relevant but not dominant
Workpiece noise contribution: Mostly well below machine noise

Environmental noise impact
Typical areas of use: Suburban/Urban/Rural ***Typical field operation:*** Dynamic
Typical usage: 3 months/year – 3 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6
Lw_g min: 94 dB(A) **Lw_g max:**120 dB(A) **Avg. Lw_g =** 109.9 dB(A) **Avg. Lw_m =** 107.1 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.8 dB
Estimated population: 25000000 ***Environmental impact indicator:* 68 (very high)**

Current situation			
Test code: ISO 9207:1995			
CE powered	***Article:*** 13	***Limits***: **none**	
Electric	***Article:*** 13	***Limits***: **none**	

ODELIA STUDY			
Test code: ISO 22868:2011			
CE powered	***Article:*** 12	***Limits***: **111+2*P** (full range)	***Decision code:*** NETF4
Electric	***Article:*** 12	***Limits***: **100+4*P** (full range)	***Decision code:*** NETF4

Economic Impact	Small, as limit proposal is not very tight.
Remarks on the test code	Clear advantages compared with ISO 9207:1995 in terms of repeatability and reproducibility. See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	The data cloud of the measured value (LWm) either of both EU and MARA databases does not shift at 2.5 kW. The proposed limit value takes into account the effect of changing the test code.

7. Combined high pressure flushers and suction vehicles

Definition
A vehicle which may work either as a high pressure flusher or as a suction vehicle. See high pressure flusher and suction vehicle.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), hydraulics, pumps, suction and flushing ***Process noise contribution:*** In some cases flushing or suction ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High idle, loaded ***Typical usage***: 10 months/year – 10 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 101 dB(A) **Lw_g max:**126 dB(A) **Avg. Lw_g =** 111.3 dB(A) **Avg. Lw_m =** 112.5 dB(A) **Avg. diff. Lw_g-Lw_m** = -1.1 dB ***Estimated population***: 21000 ***Environmental impact indicator:* 49 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **108** (P≤55 kW) **89+11*lg P** (P>55 kW) ***Decision code:*** NEMTF4
Economic Impact Only a small part of the equipment is impacted. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 26 and 52 due to similarities. ***Other Remarks*** Very few machines in databases for 26.and 52.

8. Compaction machines (only vibrating and non-vibrating rollers, vibratory plates and vibratory rammers) (a1. WB vibrating rollers, a2. Other vibrating rollers, b Non-vibrating rollers, c. Vibratory rammers, d. Vibratory plates)



Definition

A machine which compacts materials, e.g. rock fills, soil or asphalt surfacing, through a vibrating action of the working tool. It may be self-propelled, towed, walk-behind or an attachment to a carrying machine. Compaction machines are ….

Technical description

Technical parameter: Net installed power ***Unit:*** kW

Range: P≤55 kW; P>55 kW (non-vibrating)

P≤3 kW; 3 kW<P≤8 kW; 8 kW<P≤70 kW; P>70 kW (others)

Drive type: CE-petrol/diesel, 2 or 4-stroke,

***Main noise sources*:** Vibratory plate, vibration mechanism or piston, Engine. Radiation from plate, other platework or roller. Non-vibrating rollers: engine

Process noise contribution: Often, especially on hard surfaces

Workpiece noise contribution: Ground sometimes contributes to dB(A) level, but mostly machine itself. Groundborne vibrations cause secondary radiation in nearby buildings, but mostly at lower frequencies.

Environmental noise impact

Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm

Typical usage: 10 months/year – 10 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0

Sound characteristics [dB]: Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0

Lw_g min: 92 dB(A) **Lw_g max:**124 dB(A) **Avg. Lw_g =** 106.2 dB(A) **Avg. Lw_m =** 104.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.9 dB

Estimated population: 200000 ***Environmental impact indicator:* 53 (medium)**

Current situation

Test code: EN 500-4 rev. 1:1998; 2000/14/EC

Walk-behind vibrating rollers	***Article:*** 12	***Limits***: **108** (P≤8 kW) **109** (8 kW<P≤70 kW) **89+11*lg P** (P>70 kW)
Other vibrating rollers	***Article:*** 12	***Limits***: **105** (P≤8 kW) **106** (8 kW<P≤70 kW) **86+11*lg P** (P>70 kW)
Non-vibrating rollers	***Article:*** 12	***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)
Vibratory rammers	***Article:*** 12	***Limits***: **108** (P≤8 kW) **109** (8 kW<P≤70 kW) **89+11*lg P** (P>70 kW)
Vibratory plates	***Article:*** 12	***Limits***: **105** (P≤3 kW) **108** (3 kW<P≤8 kW) **109** (8 kW<P≤70 kW) **89+11*lg P** (P>70 kW)

ODELIA STUDY

Test code: EN 500-4:2011; Divide into 4 subgroups

Walk-behind vibrating rollers	***Article:*** 12	***Limits***: **105** (P≤8 kW) **106** (8 kW<P≤70 kW) **86+11*lg P** (P>70 kW)	***Decision code:*** NEMTF2

Other vibrating rollers	***Article:*** 12	***Limits***: **105** (P≤8 kW) **106** (8 kW<P≤70 kW) **86+11*lg P** (P>70 kW)	***Decision code:*** NEMTR1
Non-vibrating rollers	***Article:*** 12	***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)	***Decision code:*** NEMTR1
Vibratory rammers	***Article:*** 12	***Limits***: **107** (P≤8 kW) **108** (8 kW<P≤70 kW)	***Decision code:*** NEMTF2
Vibratory plates	***Article:*** 12	***Limits***: **105** (P≤3 kW) **107** (3 kW<P≤8 kW) **108** (8 kW<P≤70 kW) **88+11*lg P** (P>70 kW)	***Decision code:*** NEMTR1/NEMTF2

Economic Impact	Moderate effort to achieve 1 dB reduction for some subgroups.
Remarks on the test code	Comments from NB Sub-Group: ISO 6395:2008 Annex L brings insignificant higher noise test results. Test with rated speed is more reproducible and should be preferred (EN 500-4:2006).
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	Type identification difficult in databases due to several subtypes. EN 500-4:revised version applying the regrouping of category 8 equipment as proposed by CECE, and measuring rammers and vibratory plates on a gravel track. CECE and D(UBA) propose to put compaction equipment into 4 groups.

8e. Compaction machines (explosion rammers only)

Definition
A machine which compacts materials, e.g. rock fills, soil or asphalt surfacing, through a vibrating action of the working tool. It may be self-propelled, towed, walk-behind or an attachment to a carrying machine. Compaction machines are ….
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Diesel ignition ***Main noise sources*:** Ignition unit/exhaust ***Process noise contribution:*** Relevant ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Low cycle ***Typical usage***: 10 months/year – 10 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 1 ***Environmental impact indicator:* - (very low)**
Current situation
Test code: EN 500-4 rev. 1:1998 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: Remove acc. to EN 500-4:2011 ***Article:*** 0 ***Limits***: ***Decision code:*** NEL0
Economic Impact Unknown ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** There is general consensus that this equipment can be removed from the directive as it is obsolete.

9. Compressors (< 350 kW)


Definition
Any machine for use with interchangeable equipment which compresses air, gases or vapours to a pressure higher than the inlet pressure. A compressor comprises the bare compressor itself, the prime mover and any component or device supplied, …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P ≤ 15 kW; 15 kW < P < 350 kW ***Drive type:*** CE-diesel, petrol, electric ***Main noise sources*:** Engine (+exhaust+intake), compressor, intakes ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 5 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 80 dB(A) **Lw_g max:**100 dB(A) **Avg. Lw_g =** 95.8 dB(A) **Avg. Lw_m =** 93.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 2 dB ***Estimated population***: 2000000 ***Environmental impact indicator:* 50 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 12 ***Limits***: **97** (P≤15 kW) **95+2*lg P** (15 kW<P<350 kW)
ODELIA STUDY
Test code: EN ISO 2151:2008 ***Article:*** 12 ***Limits***: **96** (P≤3 kW) **95+2*lg P** (3 kW<P<350 kW) ***Decision code:*** NEMTF2
Economic Impact None ***Remarks on the test code*** Now EN ISO 2151:2008 is available ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

10. Concrete-breakers and picks, hand-held (a. CE-powered, b. Non CE-powered)


Definition			
Powered (by any method) concrete-breakers and picks used to perform work on civil engineering and building sites.			
Technical description			
Technical parameter: Mass		***Unit:*** kg	
Range: m≤15 kg; m>15 kg (CE powered)			
m≤15 kg; 15 kg<m<30 kg; m≥30 kg (Non-CE powered)			
Drive type: Pneumatic, electric, hydraulic and CE			
***Main noise sources*:** Impact between chisel and workpiece, in some cases engine noise.			
Process noise contribution: Yes			
Workpiece noise contribution: Yes, but tool may be dominant			
Environmental noise impact			
Typical areas of use: Urban/Suburban		***Typical field operation:*** High	
Typical usage: 10 months/year – 10 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0			
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6			
Lw_g min: 97 dB(A) **Lw_g max:**111 dB(A) **Avg. Lw_g =** 105.3 dB(A) **Avg. Lw_m =** 102.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.5 dB			
Estimated population: 420000		***Environmental impact indicator:* 66 (high)**	
Current situation			
Test code: 2000/14/EC			
CE powered	***Article:*** 12	***Limits***: **105** (m≤15 kg) **94+11*lg m** (m>15kg)	
Non-CE powered	***Article:*** 12	***Limits***: **105** (m≤15 kg) **92+11*lg m** (15 kg<m<30 kg) **94+11*lg m** (m≥30 kg)	
ODELIA STUDY			
Test code: EN 60745-2-6:2010			
CE powered	***Article:*** 12	***Limits***: **105** (3 kg≤m≤15 kg) **92+11*lg m** (15 kg<m<30 kg) **94+9.6*lg m** (m≥30 kg)	***Decision code:*** NETR1/NETF2
Non-CE powered	***Article:*** 12	***Limits***: **105** (3 kg<m≤15 kg) **92+11*lg m** (15 kg<m<30 kg) **94+9.6*lg m** (m≥30 kg)	***Decision code:*** NEL0/NETR1/NETF2
Economic Impact	Achievable small reduction according to database, therefore limited economic impact.		
Remarks on the test code	Comments from HSL (Health and Safety Laboratory) on EN 60745-2-6(2010): About the required test rig: “it was difficult, and in some cases impossible, to comply with all of the requirements because of omissions and technical difficulties with the specified loads". See chapter 8 remarks by Pneurop.		
Remarks on the definition			
Possible combination with other equipment			
Other Remarks	Exclude types with m<3 kg as mostly for indoor use. These have much lower EI.		

11. Concrete or mortar mixers



Definition
A machine to prepare concrete or mortar, irrespective of the loading, mixing and emptying process. It may be operated intermittently or constantly. Concrete mixers on trucks are called truck mixers (see definition 55).
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-petrol/diesel; electrical ***Main noise sources*:** Engine (+exhaust+intake) ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 92 dB(A) **Lw_g max:**118 dB(A) **Avg. Lw_g =** 103.3 dB(A) **Avg. Lw_m =** 101.7 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.6 dB ***Estimated population***: 210000 ***Environmental impact indicator:* 48 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **95** (P≤2 kW) **92+11*lg P** (P>2 kW) ***Decision code:*** NEMTF4
Economic Impact Only a small part of the equipment is impacted. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

12a. Construction winches (combustion-engine driven)

Definition
A power-operated, temporarily installed lifting appliance which is equipped with means for raising and lowering a suspended load.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤15 kW; P>15 kW ***Drive type:*** CE-petrol 2 or 4 stroke, diesel ***Main noise sources*:** Engine (+exhaust+intake), gears and winch ***Process noise contribution:*** n.a. ***Workpiece noise contribution:*** n.a.
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Maximum rpm ***Typical usage***: 10 months/year – 15 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 83 dB(A) **Lw_g max:**108 dB(A) **Avg. Lw_g =** 90.9 dB(A) **Avg. Lw_m =** 88.4 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.5 dB ***Estimated population***: 26000 ***Environmental impact indicator:* 35 (very low)**
Current situation
Test code: ISO 3744:1995 ***CE powered*** ***Article:*** 12 ***Limits***: **93** (P≤15 kW) **80+11*lg P** (P>15 kW)
ODELIA STUDY
Test code: ISO 3744:2011 ***CE powered*** ***Article:*** 12 ***Limits***: **93** (P≤15 kW) **80+11*lg P** (P>15 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Low numbers in database.

12b. Construction winches (with electric motor)


Definition
A power-operated, temporarily installed lifting appliance which is equipped with means for raising and lowering a suspended load.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Electric ***Main noise sources*:** Electric motor, gears, winch ***Process noise contribution:*** n.a. ***Workpiece noise contribution:*** n.a.
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Avarage rpm ***Typical usage***: 10 months/year – 15 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 26000 ***Environmental impact indicator:* 34 (very low)**
Current situation
Test code: ISO 3744:1995 ***Electric*** ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 3744:2011 ***Electric*** ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3
Economic Impact None as no changes occurred. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** To avoid reappearance of noisy equipment, not obsolete.

13. Conveying and spraying machines for concrete and mortar

Definition
Items of plant pumping and spraying concrete or mortar, with or without agitator, whereby the material to be transported is conveyed to the placing position through pipelines, distribution devices or distribution booms. Conveyance is carried out …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fans, pump/hydraulics ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** high ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 90 dB(A) **Lw_g max:**119 dB(A) **Avg. Lw_g =** 104.1 dB(A) **Avg. Lw_m =** 101.4 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.8 dB ***Estimated population***: 52000 ***Environmental impact indicator:* 47 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **93+11*lg P** (full range) ***Decision code:*** NEMTF4
Economic Impact Only a small part of the equipment is impacted. ***Remarks on the test code*** No better test code available. See chapter 8 remarks by CECE. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Significant number in database. For models powered by the truck engine, the according power should be used as technical parameter.

14. Conveyor belts


Definition
A temporarily installed machine suitable for transporting material by means of a power-driven belt.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*****:** Engine (+exhaust+intake), fan, rollers ***Process noise contribution:*** Possibly, for falling granulate or stones ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 111 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 52000 ***Environmental impact indicator:*** **57 (high)**
Current situation
Test code: ISO 3744:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 3744:2011 ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NETR3

Economic Impact	None as no changes occurred.
Remarks on the test code	No better test code available.
Remarks on the definition	
Possible combination with other equipment	Potential combination with truck mixers.
Other Remarks	One model in databases. Nevertheless still relevant for construction and logistics. Some models integrated with truck mixers. For models powered by the vehicle engine, the according power should be used as technical parameter.

15. Cooling equipment on vehicles

Definition
A cargo space refrigeration unit on vehicle categories N2, N3, O3 and O4 as defined by Directive 70/156/EEC. The refrigeration unit may be powered by means of an integral part of the refrigeration unit, a separate part attached to the vehicle body …
Technical description
Technical parameter: Net installed power/Electric power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel; also eutectic and alternative drive systems ***Main noise sources*:** Engine (+exhaust+intake), fans ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** High rpm ***Typical usage***: 12 months/year – 25 days/month – 720 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 80 dB(A) **Lw_g max:**110 dB(A) **Avg. Lw_g =** 91.4 dB(A) **Avg. Lw_m =** 90.4 dB(A) **Avg. diff. Lw_g-Lw_m** = 1 dB ***Estimated population***: 700000 ***Environmental impact indicator:* 59 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 12102:2013 ***Article:*** 12 ***Limits***: **CE powered: 104+2*lg P** (full range) ***Decision code:*** NETF4 **Other: 90+2*lg P** (full range)
Economic Impact Small as technology is available. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Further checks on limits versus model types required.

16. Dozers (< 500 kW) (a. Wheeled, b. Rubber tracked, c. Steel tracked)

Definition			
A self-propelled wheeled or crawler machine used to exert a push or pull force through mounted equipment.			
Technical description			
Technical parameter: Net installed power		***Unit:*** kW	
Range: P≤55 kW; 55 kW<P<500 kW			
Drive type: CE-diesel			
***Main noise sources*:** Engine (+exhaust+intake), fan, tracks			
Process noise contribution: Can be relevant if hard material is handled			
Workpiece noise contribution: Possibly dozer bucket, for hard material			
Environmental noise impact			
Typical areas of use: Urban/Suburban/Rural		***Typical field operation:*** High rpm	
Typical usage: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0			
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3			
Lw_g min: 100 dB(A) **Lw_g max:**116 dB(A) **Avg. Lw_g =** 107.1 dB(A) **Avg. Lw_m =** 105.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.8 dB			
Estimated population: 15000		***Environmental impact indicator:* 52 (medium)**	
Current situation			
Test code: ISO 6395:1998			
Wheeled	***Article:*** 12	***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)	
Rubber tracked	***Article:*** 12	***Limits***: **103** (P≤55 kW) **84+11*lg P** (55 kW<P<500 kW)	
Steel tracked	***Article:*** 12	***Limits***: **106** (P≤55 kW) **87+11*lg P** (55 kW<P<500 kW)	
ODELIA STUDY			
Test code: ISO 6395:2008 Annex C			
Wheeled	***Article:*** 12	***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)	***Decision code:*** NEMTR1
Rubber tracked	***Article:*** 12	***Limits***: **103** (P≤55 kW) **84+11*lg P** (55 kW<P<500 kW)	***Decision code:*** NEMTR1
Steel tracked	***Article:*** 12	***Limits***: **106** (P≤55 kW) **87+11*lg P** (55 kW<P<500 kW)	***Decision code:*** NEMTR1
Economic Impact	None as limits stay the same.		
Remarks on the test code	Comments from NB Sub-Group: No differences between the new and old test codes		
Remarks on the definition			
Possible combination with other equipment			
Other Remarks	Steel track noise unresolved.		

17. Drill rigs


Definition
A machine which is used for drilling holes on construction sites by - percussive drilling, - rotary drilling, - rotary percussive drilling. Drill rigs are stationary during drilling. They may move from one place of work to another under their own …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), hydraulics, gears, drilling ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 10 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 93 dB(A) **Lw_g max:**131 dB(A) **Avg. Lw_g =** 111.1 dB(A) **Avg. Lw_m =** 107.7 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.4 dB ***Estimated population***: 30000 ***Environmental impact indicator:* 50 (medium)**
Current situation
Test code: EN 791:1995 ***Percussive*** ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 791:1995 (No change) ***Percussive*** ***Article:*** 12 ***Limits***: **Percussive: 128** (full range) ***Decision code:*** NEMTF4 **Non-percussive: 107** (P≤30 kW) **92+10*lg P** (P>30 kW)
Economic Impact Moderate as about 20% will be affected. ***Remarks on the test code*** No better test code available. See chapter 8 remarks by CECE. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** None found in databases that comply with 99 dBA Limits for non-percussive drill rigs, rest in Art. 13. CECE proposes the following sub classification : 17a: Percussive (Percussive and Rotary-Percussive) 17b: Non-Percussive (Rotary and Horizontal Direction

18. Dumpers (< 500 kW)

Definition
A self-propelled machine wheeled or crawler machine having an open body, which either transports and dumps or spreads material. Dumpers may be equipped with integral self-loading equipment.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; 55 kW<P<500 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fans, gear transmission ***Process noise contribution:*** Only for unloading stones, temporarily ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 99 dB(A) **Lw_g max:**110 dB(A) **Avg. Lw_g =** 106 dB(A) **Avg. Lw_m =** 105.2 dB(A) **Avg. diff. Lw_g-Lw_m** = 0.8 dB ***Estimated population***: 30000 ***Environmental impact indicator:* 54 (medium)**
Current situation
Test code: ISO 6395:1998 ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)
ODELIA STUDY
Test code: ISO 6395:2008 Annex F ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW) ***Decision code:*** NEMTR1
Economic Impact None as limits stay the same.
Remarks on the test code Comments from NB Sub-Group: ISO 6395:2008 brings up to 1.5 dB lower noise test results, but it is more typical for the use of dumpers on construction sites. If LWA is calculated from 90% forward driving and 10% dumping, nearly the same values as before are obtained.
Remarks on the definition
Possible combination with other equipment
Other Remarks

19. Equipment for loading and unloading silos or tanks on trucks

Definition
Powered devices attached to silo or tanker trucks for loading or unloading of liquids or bulk material by means of pumps or similar equipment.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Hydraulic, electric, CE-diesel ***Main noise sources*:** Truck engine (+exhaust+intake), roots blower, pump, valves, reradiated noise from other parts. ***Process noise contribution:*** In some cases ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 100 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 105000 ***Environmental impact indicator:* 47 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN ISO 2151:2008 ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEM3
Economic Impact None as no changes occurred. ***Remarks on the test code*** Same test code as for Compressors (No.9) ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** WG7: Adopt the Compressors (9) test code. Testing the power pack (engine and compressor as installed) and not necessarily the whole trailer or truck. Insufficient data to perform statistics on the noise levels.

20. Excavators, hydraulic or rope-operated (< 500 kW)



Definition
A self-propelled crawler or wheeled machine having an upper structure capable of a minimum of 360° rotation, which excavates, swings and dumps material by the action of a bucket fitted to the boom and arm or telescopic boom, without moving the chassis …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤15 kW; 15 kW<P<500 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine(+exhaust+intake), fans, hydraulics ***Process noise contribution:*** Can be if bucket is scraped or impacted, bucket then radiates noise ***Workpiece noise contribution:*** Not often
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 90 dB(A) **Lw_g max:**109 dB(A) **Avg. Lw_g =** 99.5 dB(A) **Avg. Lw_m =** 97.6 dB(A) **Avg. diff. Lw_g-Lw_m** = 2 dB ***Estimated population***: 726000 ***Environmental impact indicator:* 57 (medium)**
Current situation
Test code: ISO 6395:1998 ***Article:*** 12 ***Limits***: **93** (P≤15 kW) **80+11*lg P** (15 kW<P<500 kW)
ODELIA STUDY
Test code: ISO 6395:2008 Annex A ***Article:*** 12 ***Limits***: **93** (P≤15 kW) **80+11*lg P** (15 kW<P<500 kW) ***Decision code:*** NEMTR1
Economic Impact None as limits stay the same. ***Remarks on the test code*** Comments from NB Sub-Group: No differences between the new and old test codes ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

21. Excavator-loaders (< 500 kW) (a. Wheeled, b. Tracked)

Definition
A self-propelled wheeled or crawler machine having a main structural support designed to carry both a frontmounted bucket loading mechanism and a rear-mounted backhoe. When used in the backhoe mode, the machine normally digs below ground level

Technical description		
Technical parameter: Net installed power		***Unit:*** kW
Range: P≤55 kW; 55 kW<P<500 kW		
Drive type: CE-diesel		
***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulics		
Process noise contribution: Only when scraping or impacting bucket on hard surfaces		
Workpiece noise contribution: No		

Environmental noise impact			
Typical areas of use: Urban/Suburban/Rural			***Typical field operation:*** Dynamic rpm
Typical usage: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0			
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3			
Lw_g min: 91 dB(A)	**Lw_g max:**108 dB(A)	**Avg. Lw_g =** 100.8 dB(A)	**Avg. Lw_m =** 98.6 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.2 dB
Estimated population: 170000			***Environmental impact indicator:* 55 (medium)**

Current situation		
Test code: ISO 6395:1998		
Wheeled	***Article:*** 12	***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)
Tracked	***Article:*** 12	***Limits***: **103** (P≤55 kW) **84+11*lg P** (55 kW<P<500 kW)

ODELIA STUDY			
Test code: ISO 6395:2008 Annex D			
Wheeled	***Article:*** 12	***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)	***Decision code:*** NEMTR1
Tracked	***Article:*** 12	***Limits***: **103** (P≤55 kW) **84+11*lg P** (55 kW<P<500 kW)	***Decision code:*** NEMTR1

Economic Impact	None as limits stay the same.
Remarks on the test code	Comments from NB Sub-Group: No differences between the new and old test codes
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	Rename to: Backhoe loaders.

22. Glass recycling containers

Definition
A container, built of whatever material, that is used for the collection of bottles. It is equipped with at least one opening for filling in bottles and another one for emptying the container.
Technical description
Technical parameter: Volume ***Unit:*** m³ ***Range:*** full ***Drive type:*** None ***Main noise sources*:** Glass breaking, sound radiation from opeing and walls ***Process noise contribution:*** Yes ***Workpiece noise contribution:*** Yes, in combination with walls
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Not applicable ***Typical usage***: 12 months/year – 30 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 98 dB(A) **Lw_g max:**106 dB(A) **Avg. Lw_g =** 100.9 dB(A) **Avg. Lw_m =** 98.9 dB(A) **Avg. diff. Lw_g-Lw_m** = 2 dB ***Estimated population***: 1000000 ***Environmental impact indicator:* 62 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **Stage I: 100** (full range) **Stage II: 96** (full range) ***Decision code:*** NETF4
Economic Impact Small as solutions are available and on the market. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

23. Graders (< 500 kW)



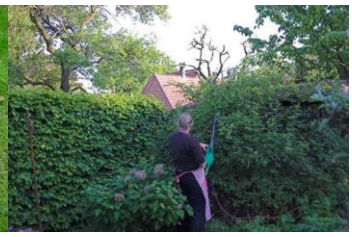
Definition
A self-propelled wheeled machine having an adjustable blade, positioned between front and rear axles, which cuts, moves and spreads material usually to grade requirements.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; 55 kW<P<500 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fan, hydraulics, scraping or impact of blade ***Process noise contribution:*** Blade can radiate noise if scraped or impacted ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic ***Typical usage***: 10 months/year – 15 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 106 dB(A) **Lw_g max:**107 dB(A) **Avg. Lw_g =** 106.6 dB(A) **Avg. Lw_m =** 103.6 dB(A) **Avg. diff. Lw_g-Lw_m** = 3 dB ***Estimated population***: 5000 ***Environmental impact indicator:* 45 (low)**
Current situation
Test code: ISO 6395:1998 ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)
ODELIA STUDY
Test code: ISO 6395:2008 Annex G ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same.
Remarks on the test code Comments from NB Sub-Group: No differences between the new and old test codes; The reverse drive operating condition in 2000/14/EC is unrealistic and difficult to realize.
Remarks on the definition
Possible combination with other equipment
Other Remarks Only 9 records in all databases.

24. Grass trimmers/grass edge trimmers

Definition
A combustion-engine driven portable hand-held unit fitted with flexible line(s), string(s), or similar non-metallic flexible cutting elements, such as pivoting cutters, intended to cut weeds, grass or similar soft vegetation. The cutting device operates in a plane ...
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Per definition with CE only ***Main noise sources*:** Engine (+exhaust+intake+fan), cutting element ***Process noise contribution:*** Generally not ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 5 months/year – 1 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** 96 dB(A) **Lw_g max:**117 dB(A) **Avg. Lw_g =** 108.8 dB(A) **Avg. Lw_m =** 105.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 3 dB ***Estimated population***: 18150000 ***Environmental impact indicator:* 62 (high)**
Current situation
Test code: ISO 10884:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 22868:2011 ***Article:*** 12 ***Limits***: **107+5.5*P** (P≤1.5 kW) **115** (P>1.5 kW) ***Decision code:*** NETF4
Economic Impact Small, as limit proposal is not very tight. ***Remarks on the test code*** Clear advantages compared with ISO 10884:1995 in terms of repeatability and reproducibility. ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 2 due to similarities. ***Other Remarks***

25. Hedge trimmers (a. CE-powered, b. Electric)





Definition
Hand-held, integrally driven powered equipment which is designed for use by one operator for trimming hedges and bushes utilising one or more linear reciprocating cutter blades.

Technical description
Technical parameter: Net installed power/Electric power ***Unit:*** kW
Range: full
Drive type: Electrical, CE-petrol 2-stroke
***Main noise sources*:** Engine (+exhaust+intake+fan), cutter mechanism
Process noise contribution: Relevant, seldom dominant
Workpiece noise contribution: No

Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High
Typical usage: 5 months/year – 1 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6
Lw_g min: 90 dB(A) **Lw_g max:**115 dB(A) **Avg. Lw_g =** 102.1 dB(A) **Avg. Lw_m =** 98.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.4 dB
Estimated population: 31020000 ***Environmental impact indicator:* 65 (high)**

Current situation			
Test code: ISO 11094:1991; 2000/14/EC			
CE powered	***Article:*** 13	***Limits***: **none**	
Electric	***Article:*** 13	***Limits***: **none**	

ODELIA STUDY			
Test code: ISO 22868:2011			
CE powered	***Article:*** 12	***Limits***: **108** (full range)	***Decision code:*** NETF4
Electric	***Article:*** 12	***Limits***: **100** (full range)	***Decision code:*** NETF4

Economic Impact	Among the CE powered models, only a small percentage of the equipment in the EU and MARA databases has a guaranteed level above the proposed limit.
Remarks on the test code	Clear advantages in terms of repeatability and reproducibility. See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	

26. High pressure flushers

Definition
A vehicle equipped with a device to clean sewers or similar installations by means of a high pressure water jet. The device may be either mounted on a proprietary vehicular truck chassis or incorporated into its own chassis embodiment. The equipment may be fixed…
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), hydraulics, pumps, suction and flushing ***Process noise contribution:*** In some cases flushing or suction ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High idle, loaded ***Typical usage***: 10 months/year – 10 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 108.4 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 53000 ***Environmental impact indicator:* 48 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **108** (P≤55 kW) **89+11*lg P** (P>55 kW) ***Decision code:*** NEMTF4
Economic Impact Only a small part of the equipment is impacted. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 7 and 52 due to similarities. ***Other Remarks*** Nearly no machines in databases for 26.and 52. Insufficient data to perform statistics on the noise levels.

27. High pressure water jet machines




Definition
A machine with nozzles or other speed-increasing openings which allow water, also with admixtures, to emerge as a free jet. In general, high pressure jet machines consist of a drive, a pressure generator, hose lines, spraying devices, safety mechanisms, controls and ...
Technical description
Technical parameter: Normal flow ***Unit:*** l/h ***Range:*** full ***Drive type:*** Electric, CE-diesel or petrol ***Main noise sources*:** Electric: pump and jet; CE: also engine (+exhaust+intake) ***Process noise contribution:*** Jet noise can be dominant for electric units, and for some CE units ***Workpiece noise contribution:*** Depending on condition of service
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic ***Typical usage***: 3 months/year – 4 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** 73 dB(A) **Lw_g max:**117 dB(A) **Avg. Lw_g =** 94.8 dB(A) **Avg. Lw_m =** 92.6 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.2 dB ***Estimated population***: 1000000 ***Environmental impact indicator:* 45 (low)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: <3kW EN 60335-2-79: 2015; ≥3kW EN 1829-1:2010 ***Article:*** 13 ***Limits***: **Art.13** ***Decision code:*** NEL3
Economic Impact None ***Remarks on the test code*** See chapter 8 remarks by EUNited and EGMF.. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Database contains a mix of CE and electric equipment, with mixed technical parameter, flow rate or power. Most with higher sound power level are combustion engine powered for industrial use. Numbers of equipment need further verification as units < 3 kW are mass product. EUnited Cleaning suggests to replace the technical parameter flow rate in ltr/h by working pressure in MPa, and to exclude oil or gas heated high pressure cleaners.

28. Hydraulic hammers


Definition
Equipment which uses the hydraulic power source source of the carrier machine to accelerate a piston which then hits a tool. The stress wave generated by kinetic action flows through the tool into the material, which causes the material …
Technical description
Technical parameter: Mass ***Unit:*** kg ***Range:*** full ***Drive type:*** Hydraulic power supply ***Main noise sources*:** Impact ***Process noise contribution:*** Dominant ***Workpiece noise contribution:*** Yes, in combination with noise from hammer
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** Not applicable ***Typical usage***: 10 months/year – 20 days/month – 26 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 110 dB(A) **Lw_g max:**137 dB(A) **Avg. Lw_g =** 123.7 dB(A) **Avg. Lw_m =** 120.7 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.1 dB ***Estimated population***: 200000 ***Environmental impact indicator:* 78 (very high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **Stage I: 120+3*lg m** (full range) **Stage II: 117+3*lg m** (full range) ***Decision code:*** NETF4
Economic Impact About 20% of the equipment is affected. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** The databases contain numerous models, some with an isolated hammer which reduces the noise. Further evaluation is required of the CECE proposal to replace mass by installed power as technical parameter.

29. Hydraulic power packs



Definition
Any machine for use with interchangeable equipment which compresses liquids to a pressure higher than the inlet pressure. It means an assembly of a prime mover, pump, with or without reservoir and accessories (e.g. controls, pressure relief valve).
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; P>55 kW ***Drive type:*** CE-petrol or diesel, mostly 4 stroke. ***Main noise sources*:** Engine (+exhaust+intake), enclosure, fans. ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 83 dB(A) **Lw_g max:**101 dB(A) **Avg. Lw_g =** 96.5 dB(A) **Avg. Lw_m =** 94.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.1 dB ***Estimated population***: 105000 ***Environmental impact indicator:* 41 (low)**
Current situation
Test code: 2000/14/EC ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (P>55 kW)
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (P>55 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

30. Joint cutters

Definition
A mobile machine intended for the production of joints in concrete, asphalt and similar road surfaces. The cutting tool is a rotating high speed disc. The forward motion of the joint cutter can be - manual, - manual with mechanical assistance, - power.driven.
Technical description
Technical parameter: Maximum blade diameter ***Unit:*** mm ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), sawblade ***Process noise contribution:*** Sawblade noise can dominate if blade is not deep into material ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 3 **Lw_g min:** 104 dB(A) **Lw_g max:**118 dB(A) **Avg. Lw_g =** 110.6 dB(A) **Avg. Lw_m =** 107.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.7 dB ***Estimated population***: 53000 ***Environmental impact indicator:* 61 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 13862:2010 ***Article:*** 12 ***Limits***: **111** (full range) ***Decision code:*** NETF4

Economic Impact	Small, as quieter sawblades are available.
Remarks on the test code	See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	Consistency with limits for other sawing machines should be observed, such as sawbenches and handheld cut-off saws.

31. Landfill compactors, loader-type with bucket (< 500 kW)

Definition
A self-propelled wheeled compaction machine having a front-mounted loader linkage with a bucket having steel wheels (drums) primarily designed to compact, move, grade and load soil, landfill or sanitary (refuse) materials.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; 55 kW<P<500 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fan noise, hydraulics ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Average rpm, average load ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 110.5 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 5000 ***Environmental impact indicator:* 27 (very low)**
Current situation
Test code: ISO 6395:1998 ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW)
ODELIA STUDY
Test code: ISO 6395:2008 Annex H ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same.
Remarks on the test code Comments from NB Sub-Group: No influence on the noise test results. The test site in 2000/14/EC should be the combination of hard reflecting plane and sand for compactors with steel wheels fitted. The operating conditions of 2000/14/EC are unrealistic (n
Remarks on the definition
Possible combination with other equipment
Other Remarks Only 2 records in all databases. Insufficient data to perform statistics on the noise levels.

32. Lawnmowers (excluding agricultural and forestry equipment, …)

Definition
A walk-behind or ride-on grass cutting machine or a machine with grass-cutting attachment(s) where the cutting device operates in a plane approximately parallel to the ground and which uses the ground to determine the height of cut by means of wheels, …
Technical description
Technical parameter: Cutting width ***Unit:*** cm ***Range:*** L≤50 cm; 50 cm<L≤70 cm; 70 cm<L≤120 cm; L>120 cm ***Drive type:*** Petrol 2- and 4-stroke, diesel 4-stroke, electric. ***Main noise sources*:** Engine (+exhaust+intake) and blade /deck; gear boxes for larger mowers ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High ***Typical usage***: 8 months/year – 0 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** 91 dB(A) **Lw_g max:**105 dB(A) **Avg. Lw_g =** 98.5 dB(A) **Avg. Lw_m =** 96.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.7 dB ***Estimated population***: 66000000 ***Environmental impact indicator:* 69 (very high)**
Current situation
Test code: ISO 11094:1991 ***Article:*** 12 ***Limits***: **96** (L≤50 cm) **98** (50 cm<L≤70 cm) **100** (70 cm<L≤120 cm) **105** (L>120 cm)
ODELIA STUDY
Test code: ISO 11094:1991 (No change) ***Article:*** 12 ***Limits***: **77+12*lg L** (L≤120 cm) **73+15*lg L** (L>120 cm) ***Decision code:*** NETF2
Economic Impact Only a relatively small part of the equipment is affected by these new limits but the overall benefits could be very high due to the large number of people affected. ***Remarks on the test code*** No better test code available. See chapter 8 remarks by EGMF. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** The limit should be a function of the technical parameter. Otherwise a slight variation in the technical parameter around the boundary value induces a large variation in the permitted limit value.

33. Lawn trimmers/lawn edge trimmers


Definition
An electrically powered walk-behind or hand-held grass cutting machine with cutting element(s) of non-metallic filament line(s) or freely pivoting non-metallic cutters with a kinetic energy of not more than 10 J each, intended to cut grass or similar soft vegetation. …
Technical description
Technical parameter: Cutting width ***Unit:*** cm ***Range:*** L≤50 cm; 50 cm<L≤70 cm; 70 cm<L≤120 cm; L>120 cm ***Drive type:*** Electric ***Main noise sources*:** Rotating cutting elements or wires ***Process noise contribution:*** Yes, but also without cutting ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Single rpm ***Typical usage***: 5 months/year – 1 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 88 dB(A) **Lw_g max:**112 dB(A) **Avg. Lw_g =** 95.8 dB(A) **Avg. Lw_m =** 92.1 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.8 dB ***Estimated population***: 18150000 ***Environmental impact indicator:* 56 (medium)**
Current situation
Test code: ISO 11094:1991 ***Article:*** 12 ***Limits***: **96** (L≤50 cm) **98** (50 cm<L≤70 cm) **100** (70 cm<L≤120 cm) **105** (L>120 cm)
ODELIA STUDY
Test code: ISO 11094:1991 (No change) ***Article:*** 12 ***Limits***: **95** (L≤50 cm) ***Decision code:*** NEMTF2
Economic Impact Only a small part of the equipment is impacted. ***Remarks on the test code*** No better test code available.. EGMF suggests product specific standard EN 50636-2-91. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** The proposed limit is only for L ≤ 50 cm. No data for machines above 50 cm.

34. Leaf blowers (a. CE-powered, b. Electric)


Definition
A powered machine appropriate to clear lawns, paths, ways, streets, etc. of leaves and other material by means of a high velocity air flow. It may be portable (hand-held) or not portable but mobile.

Technical description
Technical parameter: Net installed power/Electric power ***Unit:*** kW
Range: full
Drive type: CE-petrol, electric
***Main noise sources*:** Engine (+exhaust+intake), fan
Process noise contribution: No
Workpiece noise contribution: No

Environmental noise impact
Typical areas of use: Urban/Suburban/Rural (often around dwellings) ***Typical field operation:*** High
Typical usage: 5 months/year – 1 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6
Lw_g min: 92 dB(A) **Lw_g max:**113 dB(A) **Avg. Lw_g =** 105.1 dB(A) **Avg. Lw_m =** 102 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.1 dB
Estimated population: 6600000 ***Environmental impact indicator:* 57 (high)**

Current situation			
Test code: ISO 11094:1991; 2000/14/EC			
CE powered	***Article:*** 13	***Limits***: **none**	
Electric	***Article:*** 13	***Limits***: **none**	
ODELIA STUDY			
Test code: EN15503:2014			
CE powered	***Article:*** 12	***Limits***: **106** (P≤1.5 kW) **109** (P>1.5 kW)	***Decision code:*** NETF4
Electric	***Article:*** 12	***Limits***: **105** (full range)	***Decision code:*** NETF4

Economic Impact	Small, as quieter models exist already and the market is large. Electric and battery models will gradually increase anyway.
Remarks on the test code	See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	Combine with 35 due to similarities.
Other Remarks	Rename to: Blowers and collectors for cleaning and leaf clearing and handheld vacuum shredders.

35. Leaf collectors (a. CE-powered, b. Electric)


Definition
A powered machine suitable for collecting leaves and other debris using a suction device consisting of a power source which produces a vacuum inside the machine and a suction nozzle and a container for the collected material. It may be portable (hand-held) or not portable but mobile.

Technical description
Technical parameter: Net installed power/Electric power ***Unit:*** kW
Range: full
Drive type: CE-petrol, electric
***Main noise sources*:** Engine (+exhaust+intake), fan
Process noise contribution: No
Workpiece noise contribution: No

Environmental noise impact
Typical areas of use: Urban/Suburban/Rural (often around dwellings) ***Typical field operation:*** High
Typical usage: 5 months/year – 1 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6
Lw_g min: 93 dB(A) **Lw_g max:**112 dB(A) **Avg. Lw_g =** 106.9 dB(A) **Avg. Lw_m =** 104.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.6 dB
Estimated population: 6600000 ***Environmental impact indicator:* 59 (high)**

Current situation			
Test code: ISO 11094:1991; 2000/14/EC			
CE powered	***Article:*** 13	***Limits***: **none**	
Electric	***Article:*** 13	***Limits***: **none**	
ODELIA STUDY			
Test code: EN15503:2014			
CE powered	***Article:*** 12	***Limits***: **106** (P≤1.5 kW) **109** (P>1.5 kW)	***Decision code:*** NETF4
Electric	***Article:*** 12	***Limits***: **105** (full range)	***Decision code:*** NETF4

Economic Impact	Small, as quieter models exist already and the market is large. Electric and battery models will gradually increase anyway.
Remarks on the test code	See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	Combine with 34 due to similarities.
Other Remarks	Rename to: Blowers and collectors for cleaning and leaf clearing and handheld vacuum shredders.

36a. Lift trucks, CE driven, counterbalanced (with lifting capacity > 10 tonnes) (excluding 'other counterbalanced lift trucks' as defined in Annex I, item 36, second indent with a rated capacity of not more than 10 tonnes)


Definition
A wheeled, internal combustion-engine driven lift truck with counterweight and lifting equipment (mast, telescopic arm or articulated arm): Rough terrain trucks (wheeled counterbalanced trucks intended primarily for operation on unimproved natural terrain and on disturbed terrain of, e.g., construction sites)
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; P>55 kW ***Drive type:*** CE ***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulic ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic rpm ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** 97 dB(A) **Lw_g max:**112 dB(A) **Avg. Lw_g =** 104.2 dB(A) **Avg. Lw_m =** 102.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.4 dB ***Estimated population***: 236000 ***Environmental impact indicator:* 59 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 12 ***Limits***: **104** (P≤55 kW) **85+11*lg P** (P>55 kW)
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **102** (P≤55 kW) **83+11*lg P** (P>55 kW) ***Decision code:*** NETF2

Economic Impact	Some design effort will be required and engine and fan specifications set to suppliers. Medium impact but given timescale considered manageable.
Remarks on the test code	No better test code available. See chapter 8 remarks by FEM.
Remarks on the definition	These are rough terrain lift trucks
Possible combination with other equipment	
Other Remarks	Larger CE-powered units should be included such as reach stackers and straddle carriers. FEM states: It is very challenging to fulfil the existing limits and it will be even more difficult with the future generation of engines. Consequently there is no room for further noise reduction.

36b. Lift trucks, combustion-engine driven, couterbalanced (with lifting capacity ≤ 10 tonnes) (only 'other counterbalanced lift trucks' as defined in Annex I,item 36, second indent, with a rated capacity of not more than 10 tonnes)

Definition
A wheeled, internal combustion-engine driven lift truck with counterweight and lifting equipment (mast, telescopic arm or articulated arm): Other counterbalanced lift trucks, excluded are those counterbalanced lift trucks that are specifically constructed for container handling.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE ***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulic ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic rpm ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 104.7 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 840000 ***Environmental impact indicator:* 65 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **83+11*lg P** (P>55 kW) ***Decision code:*** NETF4
Economic Impact Small, as engine configuration is similar to rough terrain lift trucks. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

37. Loaders (< 500 kW) (a. Wheeled, b. Rubber tracked, c. Steel tracked)



Definition
A self-propelled wheeled or crawler machine having an integral front-mounted bucket-supporting structure and linkage, which loads or excavates through forward motion of the machine, and lifts, transports and discharges material.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; 55 kW<P<500 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fan, hydraulics ***Process noise contribution:*** Bucket can radiate noise if scraped or impacted ***Workpiece noise contribution:*** Seldom
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 91 dB(A) **Lw_g max:**114 dB(A) **Avg. Lw_g =** 102.6 dB(A) **Avg. Lw_m =** 101 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.6 dB ***Estimated population***: 342000 ***Environmental impact indicator:* 60 (high)**
Current situation
Test code: ISO 6395:1998 ***Wheeled*** ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW) ***Rubber tracked*** ***Article:*** 12 ***Limits***: **103** (P≤55 kW) **84+11*lg P** (55 kW<P<500 kW) ***Steel tracked*** ***Article:*** 12 ***Limits***: **103** (P≤55 kW) **87+11*lg P** (55 kW<P<500 kW)
ODELIA STUDY
Test code: ISO 6395:2008 Annex D ***Wheeled*** ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (55 kW<P<500 kW) ***Decision code:*** NETR1 ***Rubber tracked*** ***Article:*** 12 ***Limits***: **103** (P≤55 kW) **84+11*lg P** (55 kW<P<500 kW) ***Decision code:*** NETR1 ***Steel tracked*** ***Article:*** 12 ***Limits***: **103** (P≤55 kW) **87+11*lg P** (55 kW<P<500 kW) ***Decision code:*** NETR1
Economic Impact None as limits stay the same. ***Remarks on the test code*** Comments from NB Sub-Group: No differences between the new and old test codes ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Percentage of quieter hybrids may increase (no data available).

38. Mobile cranes



Definition
A self-powered jib crane capable of travelling, loaded or unloaded, without the need for fixed runways and relying on gravity for stability. It operates on tyres, crawlers or with other mobile arrangements. In fixed positions it may be supported by outriggers ...
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; P>55 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulics ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 90 dB(A) **Lw_g max:**113 dB(A) **Avg. Lw_g =** 104.9 dB(A) **Avg. Lw_m =** 102.2 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.7 dB ***Estimated population***: 105000 ***Environmental impact indicator:* 49 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (P>55 kW)
ODELIA STUDY
Test code: EN 13000:2014 ***Article:*** 12 ***Limits***: **100** (P≤55 kW) **81.5+11*lg P** (P>55 kW) ***Decision code:*** NEMTF2
Economic Impact Estimated to be limited due to available technology and solutions. ***Remarks on the test code*** See chapter 8 remarks by FEM. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** FEM indicates that about one third of the cranes currently cannot fulfil the lower limit value. This is in contrast to the database pass rates. FEM suggests not to include vehicle mounted cranes due to different test cycle and dependence on vehicle engine. FEM estimates the population to be around 25000.

39. Mobile waste containers



Definition
An appropriate designed container fitted with wheels intended to store waste temporarily, and which is equipped with a cover.
Technical description
Technical parameter: Volume ***Unit:*** m³ ***Range:*** full ***Drive type:*** None ***Main noise sources*:** Impact lid on container, rolling noise ***Process noise contribution:*** Impact/rolling ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** Not applicable, no drive ***Typical usage***: 12 months/year – 30 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 92 dB(A) **Lw_g max:**99 dB(A) **Avg. Lw_g =** 96.8 dB(A) **Avg. Lw_m =** 95 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.8 dB ***Estimated population***: 100000000 ***Environmental impact indicator:* 66 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **Stage I: 100** (full range) **Stage II: 95** (full range) ***Decision code:*** NETF4

Economic Impact	Solutions for noise reduction should not be too costly, especially considering the very large numbers of this product.
Remarks on the test code	No better test code available.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	The test code should be improved and made more practical and representative of typical use.

40. Motor hoes (< 3 kW)

Definition
A self-propelled machine designed to be pedestrian-controlled - with or without support wheel(s), in such a way that its working elements act as hoeing tools to ensure propulsion (motor hoe), and …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P<3 kW ***Drive type:*** CE-petrol (2- or 4 stroke), diesel ***Main noise sources*:** Engine (+exhaust+intake) ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Suburban/Rural ***Typical field operation:*** High idle ***Typical usage***: 6 months/year – 5 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 83 dB(A) **Lw_g max:**110 dB(A) **Avg. Lw_g =** 93.1 dB(A) **Avg. Lw_m =** 90.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.3 dB ***Estimated population***: 1050000 ***Environmental impact indicator:* 24 (very low)**
Current situation
Test code: ISO 11094:1991; 2000/14/EC ***Article:*** 12 ***Limits***: **93** (P<3 kW)
ODELIA STUDY
Test code: ISO 11094:1991; 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **93** (P<3 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Limit already rather low for open CE engine

41a. Paver-finishers (equipped with a high-compaction screed)

Definition
A mobile road construction machine used for the purpose of applying layers of construction material, such as bituminous mix, concrete and gravel on surfaces. Paver-finishers may be equipped with a high-compaction screed.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+ exhaust and intake), fans, hydraulics, impacting screed ***Process noise contribution:*** In some cases, impacting screed ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 15 days/month – 360 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 101 **Lw_g max:** 113 **Avg. Lw_g =** 106.6 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 11000 ***Environmental impact indicator:* 41 (low)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 500-6:2009 ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3
Economic Impact None as no changes occurred. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

41. Paver-finishers (excluding paver-finishers equipped with a high-compaction screed) (b1: without compacting screed, b2: with compacting screed)

Definition
A mobile road construction machine used for the purpose of applying layers of construction material, such as bituminous mix, concrete and gravel on surfaces. Paver-finishers may be equipped with a high-compaction screed.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** P≤55 kW; P>55 kW ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+ exhaust and intake), fans, hydraulics ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 15 days/month – 360 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 101 dB(A) **Lw_g max:**113 dB(A) **Avg. Lw_g =** 106.6 dB(A) **Avg. Lw_m =** 104.9 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.7 dB ***Estimated population***: 11000 ***Environmental impact indicator:* 41 (low)**
Current situation
Test code: 2000/14/EC ***Without a compacting screed*** ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (P>55 kW) ***With a compacting screed*** ***Article:*** 12 ***Limits***: **104** (P≤55 kW) **85+11*lg P** (P>55 kW)
ODELIA STUDY
Test code: EN 500-6:2009 ***Without a compacting screed*** ***Article:*** 12 ***Limits***: **101** (P≤55 kW) **82+11*lg P** (P>55 kW) ***Decision code:*** NEL1 ***With a compacting screed*** ***Article:*** 12 ***Limits***: **104** (P≤55 kW) **85+11*lg P** (P>55 kW) ***Decision code:*** NEL1
Economic Impact None as limits stay the same. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

42. Piling equipment (a. Percussive, b.Vibrating + Static)

Definition
Pile installation and extraction equipment, e.g. impact hammers, extractors, vibrators or static pile pushing/pulling devices of an assembly of machines and components used for installation or extraction of piles, which also includes: …
Technical description
Technical parameter: Impact energy (for impact piling); Static moment (for vibrators); Pushing force (for static pile devices) ***Unit:*** kJ; Nm; N
Range: full
Drive type: Diesel impact unit and/or Hydraulic power pack
***Main noise sources*:** Pile and piling hammer/vibrator, diesel impact exhaust and intake
Process noise contribution: Yes
Workpiece noise contribution: Yes, for impact hammers and vibrators steel pile or profile
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Mixed
Typical usage: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6
Lw_g min: 127 dB(A) **Lw_g max:**136 dB(A) **Avg. Lw_g =** 131.7 dB(A) **Avg. Lw_m =** 128.1 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.6 dB
Estimated population: 3000 ***Environmental impact indicator:* 70 (very high)**
Current situation
Test code: ISO 6395:1998; 2000/14/EC
Percussive ***Article:*** 13 ***Limits***: **none**
Vibrating + Static ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 16228-1:2014, EN 16228-4:2014, EN 16228-7:2014
Percussive ***Article:*** 12 ***Limits***: **132** (full range) ***Decision code:*** NETF4
Vibrating + Static ***Article:*** 12 ***Limits***: **115** (full range) ***Decision code:*** NETF4
Economic Impact Potentially high due to small numbers of these machines, although there is demand for quieter models as this can increase the allowable operating time. But various solutions have already been demonstrated for percussive equipment.
Remarks on the test code See chapter 8 remarks by CECE.
Remarks on the definition
Possible combination with other equipment
Other Remarks Very little data in databases. The test code should be improved and made more practical. Further data collection and evaluation is required.

43. Pipelayers

Definition
A self-propelled crawler or wheeled machine specifically designed to handle and lay pipes and carry pipeline equipment. The machine, the design of which is based on a tractor, has especially designed components such as undercarriage, main frame, counterweight, …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fan, hydraulics ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural (mostly rural) ***Typical field operation:*** Dynamic rpm ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 108 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 10000 ***Environmental impact indicator:* 42 (low)**
Current situation
Test code: ISO 3744:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 6395:2008 Annex K ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3

Economic Impact	None as no changes occurred.
Remarks on the test code	Comments from NB Sub-Group: ISO 6395:2008 will bring insignificant lower noise test results
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	Insufficient data to perform statistics on the noise levels.

44. Piste caterpillars

Definition
A self-propelled crawler machine used to exert a push or pull force on snow and ice through mounted equipment.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fan noise ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Mountain regions (> 1000m) ***Typical field operation:*** Rural ***Typical usage***: 5 months/year – 30 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 109.1 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 5000 ***Environmental impact indicator:* 32 (very low)**
Current situation
Test code: ISO 3744:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 15059:2009); ISO 6393:2008 ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3
Economic Impact None as no changes occurred. ***Remarks on the test code*** ***Remarks on the definition*** Rename to Snow groomers ***Possible combination with other equipment*** ***Other Remarks*** Insufficient data to perform statistics on the noise levels.

45a. Power generators (< 400 kW)




Definition
Any device comprising an internal combustion engine driving a rotary electrical generator producing a continuous supply of electrical power.
Technical description
Technical parameter: Electric power ***Unit:*** kW ***Range:*** Pel≤2 kW; 2 kW<Pel≤10 kW; 10 kW< Pel<400 kW ***Drive type:*** CE-petrol or diesel, mostly 4 stroke. ***Main noise sources*:** Engine (+exhaust+intake), enclosure, fan. ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 10 months/year – 30 days/month – 480 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 80 dB(A) **Lw_g max:**111 dB(A) **Avg. Lw_g =** 94.5 dB(A) **Avg. Lw_m =** 93.2 dB(A) **Avg. diff. Lw_g-Lw_m** = 1.3 dB ***Estimated population***: 3000000 ***Environmental impact indicator:* 60 (high)**
Current situation
Test code: ISO 8528-10:1998 ***Article:*** 12 ***Limits***: **95+lg Pel** (Pel≤2 kW) **96+lg Pel** (2 kW<Pel≤10 kW) **95+lg Pel** (10 kW< Pel<400 kW)
ODELIA STUDY
Test code: ISO 8528-10:1998 (No change) ***Article:*** 12 ***Limits***: **94+lg Pel** (Pel≤2 kW) **95+lg Pel** (2 kW<Pel≤10 kW) **94+lg Pel** (10 kW< Pel<400 kW) ***Decision code:*** NETF2
Economic Impact Europgen states that product costs are likely to increase, but not in a restrictive manner. Overall benefits could be high due to the large number of people affected. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

45b. Power generators (≥ 400kW)

Definition
Any device comprising an internal combustion engine driving a rotary electrical generator producing a continuous supply of electrical power.
Technical description
Technical parameter: Electric power ***Unit:*** kW ***Range:*** Pel≥400kW ***Drive type:*** Mostly CE-diesel 4 stroke ***Main noise sources*:** Engine (+exhaust+intake), enclosure, fan. ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 10 months/year – 30 days/month – 480 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 91 dB(A) **Lw_g max:**118 dB(A) **Avg. Lw_g =** 101.8 dB(A) **Avg. Lw_m =** 99.5 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.4 dB ***Estimated population***: 150000 ***Environmental impact indicator:* 54 (medium)**
Current situation
Test code: ISO 8528-10:1998 ***Article:*** 13 ***Limits***: **none** (Pel≥400 kW)
ODELIA STUDY
Test code: ISO 8528-10:1998 (No change) ***Article:*** 12 ***Limits***: **75+11*lg Pel** (Pel≥400 kW) ***Decision code:*** NEMTF4
Economic Impact Moderate impact can be expected for models currently without noise abatement. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

46. Power sweepers

Definition
A sweeping collection machine having equipment to sweep debris into the path of a suction inlet that would then pneumatically by way of a high velocity airstream or with a mechanical pick-up system convey the debris to a collection hopper. …
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), suction unit ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** high ***Typical usage***: 12 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 82 dB(A) **Lw_g max:**113 dB(A) **Avg. Lw_g =** 100.3 dB(A) **Avg. Lw_m =** 97.5 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.8 dB ***Estimated population***: 32000 ***Environmental impact indicator:* 50 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **96** (P≤5 kW) **89+11*lg P** (P>5 kW) ***Decision code:*** NEMTF4

Economic Impact	Only a small part of the equipment is affected.
Remarks on the test code	No better test code available. See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	109. Walk-behind sweepers and 110. street washing machine
Other Remarks	Technical parameter should be the sum of installed engine power of the main traction engine, or in the case of twin engine sweepers, the combined power of both engines. Test code is issue. EUnited Cleaning: Distinguish sweepers by standards, road-mobile sweepers and non-road mobile sweepers. Walk behind sweepers mainly for indoor use and not machines as defined in the Machinery Directive.

47. Refuse collection vehicles

Definition
A vehicle designed for the collection and transportation of domestic and bulky waste based on loading via containers or by hand. The vehicle may be equipped with a compaction mechanism. A refuse collection vehicle comprises a chassis with cab onto which ...
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Impacts by falling material/Bin against lift/Engine (+exhaust+intake)/hydraulics ***Process noise contribution:*** Yes ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** Dynamic ***Typical usage***: 12 months/year – 20 days/month – 360 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** 91 dB(A) **Lw_g max:**110 dB(A) **Avg. Lw_g =** 103.5 dB(A) **Avg. Lw_m =** 101.5 dB(A) **Avg. diff. Lw_g-Lw_m** = 2 dB ***Estimated population***: 105000 ***Environmental impact indicator:* 62 (high)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **105** (full range) ***Decision code:*** NETF4

Economic Impact	Quieter vehicles are already on the market, therefore limited impact.
Remarks on the test code	No better test code available. See chapter 8 remarks by EUnited.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	The noise test code is not representative of the work cycle. The proposed noise limit should be reconsidered when the test code is updated to full cycle test, including the lifting and emptying of bins and lowering.

48. Road milling machines

Definition
A mobile machine used for removing material from paved surfaces using a power-driven cylindrical body, on which surface the milling tools are fitted; the cutter drums rotate during the cutting operation.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fans, milling tool ***Process noise contribution:*** Relevant, but radiation from tool and attached components ***Workpiece noise contribution:*** During milling
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 15 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 102 dB(A) **Lw_g max:**118 dB(A) **Avg. Lw_g =** 109.4 dB(A) **Avg. Lw_m =** 108.4 dB(A) **Avg. diff. Lw_g-Lw_m** = 1 dB ***Estimated population***: 5000 ***Environmental impact indicator:* 44 (low)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 500-2:2009 ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3
Economic Impact None as no changes occurred. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Technical power is still technical parameter, but milling width is an additional grouping criterium.

49. Scarifiers

Definition
A walk-behind or ride-on powered machine which uses the ground to determine the depth of cut and which is equipped with an assembly appropriate to slit or scratch the surface of the lawn in gardens, parks and other similar areas.
Technical description
Technical parameter: Net installed power/Electric power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE, electric ***Main noise sources*:** Engine, blade, although balde noise is less due to no grass removal ***Process noise contribution:*** None ***Workpiece noise contribution:*** None
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High idle ***Typical usage***: 4 months/year – 10 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 84 dB(A) **Lw_g max:**114 dB(A) **Avg. Lw_g =** 99.5 dB(A) **Avg. Lw_m =** 96.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.8 dB ***Estimated population***: 1050000 ***Environmental impact indicator:* 55 (medium)**
Current situation
Test code: ISO 11094:1991 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN 13684:2010 ***Article:*** 12 ***Limits***: **99+2*lg P** (full range) ***Decision code:*** NEMTF4
Economic Impact Small as many will comply. ***Remarks on the test code*** See chapter 8 remarks by EGMF. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Databases also contain some surface scarifiers for stone and asphalt, quite noisy machines, but these do not fit in the current definition.

50. Shredders/chippers



Definition
A powered machine designed for use in a stationary position having one or more cutting devices for the purpose of reducing bulk organic materials to smaller pieces. Generally it consists of a feed intake opening through which material (which may be held by ...
Technical description
Technical parameter: Inlet ***Unit:*** mm ***Range:*** full ***Drive type:*** CE 2 stroke petrol, 4 stroke petrol/diesel, electric ***Main noise sources*:** Shredding process(radiation from tool and platework), Engine. ***Process noise contribution:*** In many cases ***Workpiece noise contribution:*** Mostly not
Environmental noise impact
Typical areas of use: Suburban/Urban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 4 months/year – 10 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** 86 dB(A) **Lw_g max:**126 dB(A) **Avg. Lw_g =** 108.5 dB(A) **Avg. Lw_m =** 106.1 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.4 dB ***Estimated population***: 1050000 ***Environmental impact indicator:* 65 (high)**
Current situation
Test code: ISO 11094:1991; 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN13683:2013 ***Article:*** 12 ***Limits***: **109** (P≤5 kW) **119** (P>5 kW) ***Decision code:*** NETF4

Economic Impact	More than 70% of machines in the database will pass the limits, which are proposed at a rather high level to allow for the wide variety in equipment types. As the technology is available, the economic impact is deemed to be limited.
Remarks on the test code	See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	Electric machines are not given separate limits as the process noise is dominant, often exceeding the noise from CE-powered types, justifying a single limit. The test code is an issue.

51. Snow-removing machines with rotating tools (self-propelled, excl. attachments)


Definition
A machine with which snow can be removed from traffic areas by rotating means, accelerated and ejected by blower means.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-petrol, diesel ***Main noise sources*:** Engine (+exhaust+intake), blower, blade scraping, snow blowing ***Process noise contribution:*** Not dominant ***Workpiece noise contribution:*** None
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 4 months/year – 5 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 90 dB(A) **Lw_g max:**113 dB(A) **Avg. Lw_g =** 103.8 dB(A) **Avg. Lw_m =** 100.5 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.3 dB ***Estimated population***: 11000 ***Environmental impact indicator:* 29 (very low)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEL3
Economic Impact None as no changes occurred. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** EUnited Municipal Equipment requests definition change to: Snow throwers according to ISO 8437, and to remove large snow removal machines as in EN 15906 due to very low impact. ***Possible combination with other equipment*** ***Other Remarks***

52. Suction vehicles


Definition
A vehicle equipped with a device to collect water, mud, sludge, refuse or similar material from sewers or similar installations by means of a vacuum. The device may be either mounted on a proprietary vehicular truck chassis or incorporated into its own chassis ...
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), hydraulics, pumps and suction ***Process noise contribution:*** In some cases suction ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High idle, loaded ***Typical usage***: 10 months/year – 10 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 3 **Lw_g min:** 104 dB(A) **Lw_g max:**112 dB(A) **Avg. Lw_g =** 107.8 dB(A) **Avg. Lw_m =** 105.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.4 dB ***Estimated population***: 11000 ***Environmental impact indicator:* 45 (low)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **108** (P≤55 kW) **89+11*lg P** (P>55 kW) ***Decision code:*** NEMTF4
Economic Impact Only a small part of the equipment is impacted. ***Remarks on the test code*** No better test code available. ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 7 and 26 due to similarities. ***Other Remarks*** Nearly no machines in databases for 26.and 52.

53. Tower cranes


Definition
A slewing jib crane with the jib located at the top of a tower which stays approximately vertical in the working position. This power-driven appliance is equipped with means for raising and lowering suspended loads and for the movement of such loads by changing ...
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Mostly electric, but a few CE powered ***Main noise sources*:** Electric motor, gear transmission ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** Normal rpm ***Typical usage***: 10 months/year – 20 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 83 dB(A) **Lw_g max:**98 dB(A) **Avg. Lw_g =** 95.8 dB(A) **Avg. Lw_m =** 92.1 dB(A) **Avg. diff. Lw_g-Lw_m** = 3.7 dB ***Estimated population***: 21000 ***Environmental impact indicator:* 33 (very low)**
Current situation
Test code: 2000/14/EC ***Article:*** 12 ***Limits***: **96+lg P** (full)
ODELIA STUDY
Test code: EN 14439:2010 ***Article:*** 12 ***Limits***: **96+lg P** (full range) ***Decision code:*** NEL1
Economic Impact None as limits stay the same. ***Remarks on the test code*** See chapter 8 remarks by FEM. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Only 2 records in all databases.

54. Trenchers



Definition
A self-propelled, ride-on or pedestrian-controlled, crawler or wheeled machine, having a front- or rear-mounted excavator linkage and attachment, primarily designed to produce trenches in a continuous operation, through a motion of the machine.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel and petrol ***Main noise sources*:** Engine (+exhaust+intake), fan, scraping/impacting ***Process noise contribution:*** Scrapping ***Workpiece noise contribution:*** None
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 10 months/year – 20 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 100 dB(A) **Lw_g max:**117 dB(A) **Avg. Lw_g =** 106.6 dB(A) **Avg. Lw_m =** 104 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.6 dB ***Estimated population***: 21000 ***Environmental impact indicator:* 45 (low)**
Current situation
Test code: ISO 3744:1995 ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: ISO 6395:2008 Annex I ***Article:*** 13 ***Limits***: **none** ***Decision code:*** NEMTF4
Economic Impact None as no changes occurred. ***Remarks on the test code*** Comments from NB Sub-Group: ISO 6395:2008 will bring insignificant higher noise test results, but trenchers are in article 13. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks***

55. Truck mixers


Definition
A vehicle which is equipped with a drum to transport ready-mixed concrete from the concrete mixing plant to the job site; the drum may rotate when the vehicle is driving or stand still. The drum is emptied on the job site by rotating the drum. The drum is driven ...
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulic transmission, noise radiation of drum during mixing, and dumping ***Process noise contribution:*** Present but not dominant ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic rpm ***Typical usage***: 12 months/year – 20 days/month – 20 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** 105 dB(A) **Lw_g max:**115 dB(A) **Avg. Lw_g =** 111.1 dB(A) **Avg. Lw_m =** 104.8 dB(A) **Avg. diff. Lw_g-Lw_m** = 6.3 dB ***Estimated population***: 30000 ***Environmental impact indicator:* 47 (medium)**
Current situation
Test code: 2000/14/EC ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: 2000/14/EC (No change) ***Article:*** 12 ***Limits***: **109** (P≤55 kW) **90+11*lg P** (P>55 kW) ***Decision code:*** NEMTF4
Economic Impact Small as limits well exceed EU heavy truck noise limits. ***Remarks on the test code*** No better test code available. See chapter 8 remarks by CECE. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Limits can be compared to 2014 EU limit for pass-by test value for heavy trucks > 250 kW. LW = LpAFmax + 10 lg ($2\pi r^2$) = 81+25.5=106.5 Truck engine power + auxiliary power should be used as technical parameter, see the very limited selected data from databases. More data is required to assess the limit proposal.

56. Water pump units (not for use under water)



Definition
A machine consisting of a water pump itself and the driving system. Water pump means a machine for the raising of water from a lower to a higher energy level.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** ***Main noise sources*:** Engine (+exhaust+intake), fan, pump ***Process noise contribution:*** Pumping noise for electrically powered pumps ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 4 months/year – 5 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 90 dB(A) **Lw_g max:**118 dB(A) **Avg. Lw_g =** 105.8 dB(A) **Avg. Lw_m =** 103.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 2.5 dB ***Estimated population***: 1050000 ***Environmental impact indicator:* 57 (high)**
Current situation
Test code: 2000/14/EC ***CE powered*** ***Article:*** 13 ***Limits***: **none**
ODELIA STUDY
Test code: EN ISO 20361:2015 ***CE powered*** ***Article:*** 12 ***Limits***: **CE powered: 109** (P≤25 kW) **94+11*lg P** ***Decision code:*** NETF4 (P>25 kW) **Electric: 99** (full range)
Economic Impact Some of the open CE models will be affected, requiring quieter pumps and engines and/or partial damping or encapsulation. ***Remarks on the test code*** See chapter 8 remarks by EGMF. ***Remarks on the definition*** Expand definition to include swimming pool pumps. ***Possible combination with other equipment*** ***Other Remarks***

57. Welding generators

Definition
Any rotary device which produces a welding current.
Technical description
Technical parameter: Electric power ***Unit:*** kW ***Range:*** Pel≤2 kW; 2 kW<Pel≤10 kW; Pel>10 kW ***Drive type:*** CE-petrol or diesel, mostly 4-stroke ***Main noise sources*:** Engine (+exhaust+intake), enclosure, fan. ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 10 months/year – 20 days/month – 360 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** 90 dB(A) **Lw_g max:**97 dB(A) **Avg. Lw_g =** 94.2 dB(A) **Avg. Lw_m =** 93.3 dB(A) **Avg. diff. Lw_g-Lw_m** = 0.8 dB ***Estimated population***: 1050000 ***Environmental impact indicator:* 53 (medium)**
Current situation
Test code: ISO 8528-10:1998 ***Article:*** 12 ***Limits***: **95+lg Pel** (Pel≤2 kW) **96+lg Pel** (2 kW<Pel≤10 kW) **95+lg Pel** (Pel>10 kW)
ODELIA STUDY
Test code: ISO 8528-10:1998 (No change) ***Article:*** 12 ***Limits***: **94+lg Pel** (Pel≤2 kW) **95+lg Pel** (2 kW<Pel≤10 kW) **94+lg Pel** (Pel>10 kW) ***Decision code:*** NEMTF2
Economic Impact Product costs are likely to increase, but not in a restrictive manner. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Less data in databases than for generators and smaller difference between guaranteed and measured levels.

102. Mobile sieve installations

Definition
Suggestion: Mobile machine for grading, sorting, screening or sifting of materials including stones, rubble, sand, seeds, produce, granulates and others.

Technical description
Technical parameter: Net installed power ***Unit:*** kW
Range: full
Drive type: CE-diesel
***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulics, screens, rubble noise.
Process noise contribution: In some cases.
Workpiece noise contribution: Sometimes rubble or material impacting, however, machinery platework may radiate noise.

Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm.
Typical usage: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3
Lw_g min: **Lw_g max:** **Avg. Lw_g =** 110 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =**
Estimated population: 9000 ***Environmental impact indicator:* 54 (medium)**

Current situation
Test code: n.a.
Article: n.a. ***Limits***:

ODELIA STUDY
Test code: ISO 3744:2011
Article: 12/13 ***Limits***: **Stage I: Art.13 Stage II: Art.12** (Limit needs evaluation) ***Decision code:*** CNETR6

Economic Impact	May be moderate due to the variety of machine types and the initial effort to improve designs.
Remarks on the test code	Difficult to determine the designated use for all the different applications. Lack of test code should be addressed. See chapter 8 remarks by CECE.
Remarks on the definition	
Possible combination with other equipment	
Other Remarks	Large variety with different working principles and question of operating condition and materials for test.

103. Mobile waste breakers (wood, concrete)

Definition
Suggestion: Mobile equipment for breaking, crushing and sorting materials such as stone, rubble, wood, refuse and recycled matter.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulics, crusher, screens, rubble noise. ***Process noise contribution:*** In some cases. ***Workpiece noise contribution:*** Sometimes rubble or material impacting, however, machinery platework may radiate noise.
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 3 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 120 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 6000 ***Environmental impact indicator:* 49 (medium)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: ISO 3744:2011 ***Article:*** 12/13 ***Limits***: **Stage I: Art.13 Stage II: Art.12** (Limit needs evaluation) ***Decision code:*** CNETR6
Economic Impact May be moderate due to the variety of machine types and the initial effort to improve designs.
Remarks on the test code Many different work-principles and types on the market. So it will be difficult to determine the designated use for all the different applications. But only loaded measurement and declaration makes sense. Testing material must be determined. Lack of test code should be addressed.See chapter 8 remarks by CECE.
Remarks on the definition
Possible combination with other equipment
Other Remarks Large variety with different working principles and question of operating condition and materials for test.

107. Portal cranes for harbours and terminals


Definition
Suggestion: Cranes for harbours or terminals for lifting and moving freight, rail guided.

Technical description
Technical parameter: Net installed power ***Unit:*** kW
Range: full
Drive type: Electric or CE-diesel
***Main noise sources*:** Winch enclosure: motor/engine, alternator/converters, gears, cooling fans; trolley: rolling noise, cable runner impacts; container: impacts with spreader and ground.
Process noise contribution: Trolley, winch, spreader
Workpiece noise contribution: Impact noise from containers

Environmental noise impact	
Typical areas of use: Urban/Rural	***Typical field operation:*** Work cycle including trolley movement, hoisting and lifting, spreader onto container, crane moving.
Typical usage: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5	
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3	
Lw_g min: **Lw_g max:** **Avg. Lw_g =** 110 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =**	
Estimated population: 30000	***Environmental impact indicator:* 56 (medium)**

Current situation		
Test code: n.a.		
	Article: n.a.	***Limits***:

ODELIA STUDY		
Test code: Check for scope, industrial use.		
	Article: 13	***Limits***: **none** ***Decision code:*** CNEL6

Economic Impact	Small, mainly the testing
Remarks on the test code	German standard DIN 45635 T 61 may be used to define microphone positions and test cycle. Test code and practical execution of the test are an issue.
Remarks on the definition	
Possible combination with other equipment	Jig cranes could also be considered to include in the definition.
Other Remarks	.FEM estimates population at around 10000.

108. Vehicle mounted loader cranes

Definition
Suggestion: Vehicle mounted crane for loading and unloading the vehicle itself.

Technical description
Technical parameter: Net installed power ***Unit:*** kW
Range: full
Drive type: CE-diesel
***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulics
Process noise contribution: No
Workpiece noise contribution: No

Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic
Typical usage: 10 months/year – 20 days/month – 30 minutes/day - Evening/night adj (0 to 5) = 0
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3
Lw_g min: **Lw_g max:** **Avg. Lw_g =** 100 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =**
Estimated population: 1000000 ***Environmental impact indicator:* 53 (medium)**

Current situation
Test code: n.a.
Article: n.a. ***Limits***:

ODELIA STUDY
Test code: EN 13000:2014
Article: 12 ***Limits***: **100** (P≤55 kW) **81.5+11*lg P** (P>55 kW) ***Decision code:*** C8 (NEMTF2)

Economic Impact	Small as the test and noise declaration should be performed by the manufacturer who installs the crane on the vehicle.
Remarks on the test code	The carrier vehicle is the main noise source. The manufacturer of an attached loader crane has no influence on this. Testing with an electric driven hydraulic pump is the only possibility to get a sound power level of the loader crane separately.
Remarks on the definition	
Possible combination with other equipment	Combine with 38. or otherwise put into separate category. FEM is against combining with 38.
Other Remarks	Product standard is EN 12999

109. Walk-behind road sweepers, no aspirators (motorized broom)

Definition
The EN 12733 definition is: A pedestrian controlled, self-propelled machine, with front mounted sweeping attachments, with sweeping and/or collecting system.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-petrol/diesel ***Main noise sources*:** Engine (+exhaust+intake) ***Process noise contribution:*** Sweeping noise ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban ***Typical field operation:*** High rpm. ***Typical usage***: 12 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 95 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 25000 ***Environmental impact indicator:* 41 (low)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: 2000/14/EC (as for sweepers) ***Article:*** 12 ***Limits***: **96** (P≤5 kW) **89+11*lg P** (P>5 kW) ***Decision code:*** C8 (NEMTF4)
Economic Impact As for sweepers. ***Remarks on the test code*** ***Remarks on the definition*** Include with road sweepers, improve definition if necessary for walk behind sweepers. ***Possible combination with other equipment*** Combine with 46. and 110. ***Other Remarks***

110. Street washing machine

Definition
Suggestion: Vehicle for spray-cleaning of roads and paths including a liquid storage tank and means for spraying the liquid onto the road surface.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** ***Main noise sources*:** Engine, pump and spray unit ***Process noise contribution:*** Water spray ***Workpiece noise contribution:*** None
Environmental noise impact
Typical areas of use: ***Typical field operation:*** ***Typical usage***: 12 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 100 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 25000 ***Environmental impact indicator:* 45 (low)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: 2000/14/EC (as for sweepers) ***Article:*** 12 ***Limits***: **96** (P≤5 kW) **89+11*lg P** (P>5 kW) ***Decision code:*** C8 (NEMTF4)
Economic Impact Unknown, depending on the options for water spray systems. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** Include with 46. road sweepers, or 7. combined high p[ressure flushers and suction vehicles updating definition: 'Road sweepers and washers'. ***Other Remarks***

111. Snowmobiles

Definition
Suggestion: Tracked powered vehicle for transport of persons and goods over snow and ice.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-petrol, 2-stroke/4stroke ***Main noise sources*:** Engine (+exhaust+intake), fan ***Process noise contribution:*** No ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Rural ***Typical field operation:*** Transport: medium rpm; Sports use: high rpm. ***Typical usage***: 4 months/year – 10 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 105 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 250000 ***Environmental impact indicator:* 34 (very low)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: SAE J 192, Jan. 2013 ***Article:*** 12 ***Limits***: **78** (LpASmax @ 15.2m, accelerating) ***Decision code:*** CNTF7
Economic Impact Small as already achievable for some current models. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Convert LpAS to LW to allow labelling (LW=LpASmax + 31.6). Scope issue: Transport of persons is not consistent with the scope of the OND

115. Telescopic or pole pruner (a. CE-powered b. Electric)

Definition

Suggestion: Extendable pole-mounted combustion engine or electrically powered chainsaw for pruning branches.

Technical description

Technical parameter: Net installed power ***Unit:*** kW

Range: full

Drive type: CE and electric

***Main noise sources*:** Engine (+exhaust+intake+fan), blade, chain and cutting process

Process noise contribution: Relevant but not dominant

Workpiece noise contribution: Mostly well below machine noise

Environmental noise impact

Typical areas of use: Suburban/Urban/Rural ***Typical field operation:*** Dynamic

Typical usage: 1 months/year – 3 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0

Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 6

Lw_g min: **Lw_g max:** **Avg. Lw_g =** 110 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =**

Estimated population: 173000 ***Environmental impact indicator:* 49 (medium)**

Current situation

Test code: n.a.

Article: n.a. ***Limits***:

ODELIA STUDY

Test code: ISO 22868:2011

Article: 12 ***Limits***: **CE powered: 111+2*P** (full range) **Electric: 100+4*P** (full range) ***Decision code:*** C8 (NETF4)

Economic Impact	Same as for chainsaws
Remarks on the test code	See chapter 8 remarks by EGMF.
Remarks on the definition	
Possible combination with other equipment	Combine with 6. and 120.
Other Remarks	

117. Straddle carrier

Definition
Suggestion: A powered vehicle for lifting and moving containers or freight units, having a portal structure capable of driving above stacked containers.

Technical description
Technical parameter: Net installed power ***Unit:*** kW
Range: full
Drive type: CE
***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulic
Process noise contribution: Handling noise of containers (impacts, potentially avoided by electronic control)
Workpiece noise contribution: If impacts occur, then noise from containers.

Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic rpm
Typical usage: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5
Sound characteristics [dB]: Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3
Lw_g min: **Lw_g max:** **Avg. Lw_g =** 110 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =**
Estimated population: 7000 ***Environmental impact indicator:* 31 (very low)**

Current situation
Test code: n.a.
Article: n.a. ***Limits***:

ODELIA STUDY		
Test code: 2000/14/EC (as for lift trucks)		
Article: 12	***Limits***: **102** (P≤55 kW) **83+11*lg P** (P>55 kW) **(P>55 kW)**	***Decision code:*** C8 (NETF2)

Economic Impact	Less than for lift trucks
Remarks on the test code	
Remarks on the definition	
Possible combination with other equipment	Combine with 36a.and 118.
Other Remarks	Data collection and verification required.

118. Reach stacker

Definition
Suggestion: Powered equipment for lifting and moving containers and freight units capable of also extending the lifting device horizontally.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE ***Main noise sources*:** Engine (+exhaust+intake), fans, hydraulic ***Process noise contribution:*** Handling noise of containers (impacts, potentially avoided by electronic control) ***Workpiece noise contribution:*** If impacts occur, then noise from containers.
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** Dynamic rpm ***Typical usage***: 10 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 3 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 110 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 10000 ***Environmental impact indicator:* 42 (low)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: 2000/14/EC (as for lift trucks) ***Article:*** 12 ***Limits***: **102** (P≤55 kW) **83+11*lg P** (P>55 kW) **(P>55 kW)** ***Decision code:*** C8 (NETF2)
Economic Impact Less than for lift trucks ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 36a.and 117. ***Other Remarks*** Data collection and verification required.

119. Handheld stone cut-off saw

Definition
Suggestion: Handheld circular saw for cutting stone and masonry materials. ISO 19432: 2012 includes definition
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE petrol 2-stroke ***Main noise sources*:** Engine (+exhaust+intake+fan), sawblade and workpiece ***Process noise contribution:*** Yes, but engine may be dominant ***Workpiece noise contribution:*** Relevant, but sawblade stronger than workpiece
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm. ***Typical usage***: 6 months/year – 5 days/month – 60 minutes/day - Evening/night adj (0 to 5) = 0 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 115 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 100000 ***Environmental impact indicator:* 63 (high)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: EN 13862:2010 ***Article:*** 12 ***Limits***: **112+2*P** (full range) ***Decision code:*** CNETF7
Economic Impact Should be limited if existing technology is applied. ***Remarks on the test code*** Test code to be verified.See chapter 8 remarks by EGMF. ***Remarks on the definition*** ***Possible combination with other equipment*** ***Other Remarks*** Actually fits in to the definition of 30. Joint cutter, but EGMF prefers to put handheld units into a separate group due to differences in weight, support, performance and blade size.

120. Stone chainsaw

Definition

Suggestion: Chainsaw suitable for sawing bricks, stones and other hard materials.

Technical description

Technical parameter: Net installed power ***Unit:*** kW

Range: full

Drive type: CE and electric

***Main noise sources*:** Engine (+exhaust+intake+fan), blade, chain and cutting process

Process noise contribution: Relevant but not dominant

Workpiece noise contribution: Mostly well below machine noise

Environmental noise impact

Typical areas of use: Suburban/Urban/Rural ***Typical field operation:*** Dynamic

Typical usage: 6 months/year – 1 days/month – 120 minutes/day - Evening/night adj (0 to 5) = 0

Sound characteristics [dB]: Tonality (0 to 5) = 5 - Impulsivity (0 to 5) = 5 - Intermittency (0,3,6) = 6

Lw_g min: **Lw_g max:** **Avg. Lw_g =** **Avg. Lw_m =** 117 **Avg. diff. Lw_g-Lw_m =**

Estimated population: 20000 ***Environmental impact indicator:* 54 (medium)**

Current situation

Test code: n.a.

Article: n.a. ***Limits***:

ODELIA STUDY

Test code: ISO 22868:2011

Article: 12 ***Limits***: **CE powered: 111+2*P** (full range) **Electric: 100+4*P** (full range) ***Decision code:*** C8 (NETF4)

Economic Impact	Should be limited as machines fulfilling limits are already on the market.
Remarks on the test code	
Remarks on the definition	Definition should be modified to include stone: 'A power-driven tool designed to cut wood or other materials including stone, cement or breeze blocks…', or as above.
Possible combination with other equipment	Combine with 6. and 115.
Other Remarks	

121. Swimming pool pumps

Definition
As for water pumps, but including 'for swimming pools'.
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** Mainly electric ***Main noise sources*:** Engine (+exhaust+intake), fan, pump ***Process noise contribution:*** Pumping noise for electrically powered pumps ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High rpm ***Typical usage***: 1 months/year – 1 days/month – 480 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 100 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 50000 ***Environmental impact indicator:* 40 (low)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: EN ISO 20361:2015 ***Article:*** 12 ***Limits***: **CE powered: 109** (P≤25 kW) **94+11*lg P** (P>25 kW) **Electric: 99** (full range) ***Decision code:*** C8 (NETF4)
Economic Impact Same considerations as for other water pumps if put into Article 12. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 56. ***Other Remarks*** Improve water pump definition if necessary, '…including swimming pool pumps…'

122. Air suction refuse clearing vehicles

Definition
Update definition of equipment type 7. High pressure flushers or suction vehicles, with 'including Air suction vehicles for refuse clearing'
Technical description
Technical parameter: Net installed power ***Unit:*** kW ***Range:*** full ***Drive type:*** CE-diesel ***Main noise sources*:** Engine (+exhaust+intake), hydraulics, pumps, suction and flushing ***Process noise contribution:*** In some cases flushing or suction ***Workpiece noise contribution:*** No
Environmental noise impact
Typical areas of use: Urban/Suburban/Rural ***Typical field operation:*** High idle, loaded ***Typical usage***: 12 months/year – 20 days/month – 240 minutes/day - Evening/night adj (0 to 5) = 5 ***Sound characteristics [dB]:*** Tonality (0 to 5) = 0 - Impulsivity (0 to 5) = 0 - Intermittency (0,3,6) = 0 **Lw_g min:** **Lw_g max:** **Avg. Lw_g =** 111.3 **Avg. Lw_m =** **Avg. diff. Lw_g-Lw_m =** ***Estimated population***: 10000 ***Environmental impact indicator:* 50 (medium)**
Current situation
Test code: n.a. ***Article:*** n.a. ***Limits***:
ODELIA STUDY
Test code: 2000/14/EC (as for high pressure flushers) ***Article:*** 12 ***Limits***: **108** (P≤55 kW) **89+11*lg P** (P>55 kW) ***Decision code:*** NEMTF4
Economic Impact Same considerations as for equipment type 7 if put into Article 12. ***Remarks on the test code*** ***Remarks on the definition*** ***Possible combination with other equipment*** Combine with 7. ***Other Remarks***