

Noise emission data as a prerequisite for Buy Quiet: Challenges related to the European Machinery and Outdoor Noise Directive

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Abstract

The European OSH Directive 2003/10/EC on noise comprises provisions aimed at “avoiding or reducing the exposure” of workers to noise, so that “... the risks arising from exposure to noise shall be eliminated at source or reduced to a minimum”(Article 5 1.). The Buy Quiet concept, i.e. the selection of machinery and equipment with a special focus on low noise emissions, can represent an effective means to comply with this legal requirement. However, reliable and useful noise emission data are not always available. Especially outdoor equipment can represent a challenge. This kind of machinery is covered by both the “Outdoor Noise” Directive 2000/14/EC (OND), a Global Approach Directive, and the Machinery Directive 2006/42/EC (MD), a New Approach Directive. The interplay of these two Directives results in noise emission declarations that differ from those of other machinery and can represent a challenge for manufacturers as well as employers. The arising problems are discussed and explained by practical observations. Equipment covered by the OND is almost always provided with emission data. The challenges when trying to select quieter machines based on these data are discussed and possible strategies to identify quieter machines, but also to improve the OND, are presented.

Keywords: Noise, Regulation, Buy Quiet

1 INTRODUCTION

Despite the knowledge of and regulations aimed at preventing noise-induced hearing loss, the number of recognized cases of this occupational disease (OD No. 2301) remained more or less constant in Germany. The German Social Accident Insurance (DGUV) recognized 6.216, 6.850 and 6.649 cases in the years 2015, 2016 and 2017, respectively(1). According to the recent BIBB-BAuA survey(2), conducted in 2018, 13,6 % of the questioned employees claimed to be working frequently under noise and to be bothered by it. Being asked “What is the main cause of noise nuisance?” 57,3 % of these employees replied “machines and other equipment”. Thus, noise emission from machines remains an important issue for occupational health and safety.

Noise as a physical agent and a hazard for the hearing of workers is addressed by the OSH Directive 2003/10/EC on noise(3). This Directive aims at avoiding or reducing the risks arising from exposure of workers to noise. However, these measures are connected to the action values of daily noise exposure levels of 80 dB(A) and 85 dB(A), so that possible non-auditory effects of noise below 80 dB(A) are not explicitly addressed by this Directive. The goal is that “... the risks arising from exposure to noise shall be eliminated at source or reduced to a minimum”(3, Article 5 1.). Employers have the responsibility to protect the workers from hazards resulting from noise at the workplace. The Buy Quiet concept, i.e. the selection of machinery and equipment with a special focus on low noise emissions, can represent an effective means to comply with this legal requirement. Furthermore, employers “shall give particular attention, when carrying out the risk assessment, to ... information on noise emission provided by manufacturers of work equipment in accordance with the relevant Community directives”(3, Article 4 6.).

Both the Buy Quiet concept as a means to minimize noise exposure and the risk assessment require the employer to obtain and interpret noise emission data provided with machinery and other work equipment. “Relevant Community directives” obligating manufacturers to provide such information are the “Outdoor Noise” Directive 2000/14/EC(4), short OND hereinafter, and the Machinery Directive 2006/42/EC(5), short MD hereinafter. However, both Directives have slightly different goals and different approaches to the provision of noise

emission information. Whereas both the OND and the MD are based on Article 95 of the EC Treaty (now replaced by Article 114 of the Treaty on the Functioning of the European Union) and thereby aim “at the establishment and functioning of the internal market”(6) the issues addressed by them differ already(7):

On the one hand, the MD harmonizes “the health and safety requirements applicable to machinery on the basis of a high level of protection of health and safety”(6). Thus, noise is only one hazard among many others addressed by the “essential health and safety requirements” (EHSR) of the MD. The OND, on the other hand, aims at “a high level of environmental protection and consumer protection”(8), whereupon it solely contains requirements regarding noise.

The MD is a New Approach Directive and thus only defines essential requirements for the products in its scope, whereas “... the technical specifications for products meeting the essential requirements set out ...”(9) by the MD “... should be laid down in harmonised standards”. The harmonized standards, which can be used to document conformity with the essential requirements of the MD within the scope of the specific standard, are updated periodically following technical progress and adapting to the state of the Art. Note, however, that the application of harmonised standards is voluntary, but offers manufacturers the advantage of the presumption of conformity with those EHSRs, which are within the scope of the specific standard used (MD, Article 7(2)).

The OND is a Global Approach Directive which sets out detailed technical specifications for the products in its scope. However, it only specifies requirements regarding the noise emissions of 57 different types of equipment for use outdoors. In contrast to the MD, it contains dated references to standards. As a result, no changes to the measurement methods or operating conditions are permissible. This shall ensure that the noise emission data produced according to the OND can always be compared and that the effect of the limit values, imposed on 22 types of equipment by the OND, cannot be undermined by changing the measurement methods and/or operating conditions.

Problems due to the different approaches of both Directives may arise for the 55 types of equipment covered by the OND which also fall under the scope of the MD. Here, the sound power level (see Sect. 2) has to be declared in the EC declaration of conformity and labelled on the machine following the provisions of the OND, but the other important quantity regarding noise emissions and the regulation of noise at the workplace, the emission sound pressure level at the workstation, has to be declared in the instructions.

The exact requirements regarding noise of the two Directives are described in Sec. 2. Sec. 3 provides guidance to choose quiet outdoor equipment. Sec. 4 analyses problems that might be encountered following this guidance, whereas Sec. 6 discusses proposals to improve the current situation and the interplay of the two Directives.

2 THE APPROACH OF THE DIRECTIVES REGARDING NOISE EMISSIONS

2.1 Outdoor Noise Directive

The OND demands the determination and declaration of the A-weighted sound power level L_{WA} of outdoor equipment within its scope. It shall be declared as a single number, already containing the uncertainty of the measurement and the uncertainty due to product variations. The resulting quantity is the guaranteed sound power level L_{WAd} which must not be exceeded when the noise emissions of the product are checked, e.g. by a market surveillance authority. To allow consumers an easy comparison of competing products the L_{WAd} must be labelled on the product (OND, Article 11). Furthermore, this quantity has to be provided in the EC declaration of conformity together with the measured sound power level. The measurement method and the operating conditions to determine the measured sound power level are specified in the OND. They are either contained directly in the Directive or provided by *dated* references to European and/or international standards. Thus, a lot of these references refer to outdated and partly even to withdrawn or superseded standards. Due to the detailed specification of the measurement method and the operating conditions in the Directive, the guaranteed sound power level L_{WAd} should be easily comparable. However, the method to determine the uncertainty added to the measured sound power level is not specified - neither in the OND itself nor in the standards referenced - and the product variations, which are part of the uncertainty, may vary between different manufacturers/different

designs of equipment of the same type, so that differences in the uncertainty can limit the comparability of the guaranteed sound power level L_{WAd} .

The 57 types of equipment, covered by the OND, can be divided into two groups: 22 types of equipment are subject to limit values, which restrict their guaranteed sound power level to a certain maximum, whereas the remaining 35 types of equipment only have to be labelled with a guaranteed sound power.

In contrast to the MD (see Sec. 2.2), the approach of the OND solely consists of noise limits and noise labelling, so that a reduction of the sound power level below the limit value (equipment subject to noise limits) or of equipment subject to noise labeling only is dependent on market forces, i.e. employers or consumers demanding and buying quiet equipment. However, most outdoor equipment (55 of 57 types) is also covered by the MD (see Sec. 2.2), so its noise requirements apply to these types of equipment, too.

A further difference to the MD is the collection of noise data in a database, set up and updated periodically by the European Commission (OND, Article 20). To that end the Member States (MS) shall ensure that manufacturers (or their authorised representatives) send a copy of the EC declaration of conformity to the responsible authority of the MS, where the equipment is placed on the market, put into service or where the manufacturer resides, and to the European Commission (OND, Article 16).

However, the data is provided with a disclaimer (“... whilst every effort was taken to ensure the accuracy of the data provided, errors may still exist.”(10)) and several problems with the database have been identified(11): Obsolete machines, repeated records (for each received declaration of conformity an entry is made), wrong type of equipment chosen, a fixed name (“Net installed power”) for the noise related quantity regardless of the type of equipment and false or missing entries (e.g. a declared sound power level exceeding the permissible sound power level). According to *Pedrielli et al.*(11) errors result in part from the absence of a reliability check of the input data.

2.1.1 Article 12: Equipment subject to noise limits

Article 12 of the OND lists 22 types of outdoor equipment, which are subject to limit values for the guaranteed sound power level L_{WAd} - “Art. 12 equipment” hereinafter. These limits are specified within the Directive (Global Approach Directive). They were supposed to be reassessed and eventually lowered regularly (every four years). The first stage of limit values came into force on January 3, 2002. However, the amendment 2005/88/EC(12) to the OND prevented a lowering of the limit values for many types of equipment, since the Working Group on Outdoor Equipment “... concluded that a number of the stage II limits due to be mandatorily applied as from 3 January 2006 were not technically feasible.”(12) As a result, stricter limit values were introduced only for 11 of the 22 types of Art. 12 equipment. Since 3 January 2006 no stricter limit values on any of the 22 types of this equipment have been introduced.

Note that in order to place Art. 12 equipment on the market the manufacturer has to involve a Notified Body (NB) for the conformity assessment. To that end the manufacturer can choose between three different procedures: internal control of production with assessment of technical documentation and periodical checking (Annex VI, OND), unit verification (Annex VII, OND) and full quality assurance (Annex VIII, OND).

2.1.2 Article 13: Equipment subject to noise labeling only

Article 13 of the OND lists 35 types of outdoor equipment, which have to be labelled with the L_{WAd} - “Art. 13 equipment” hereinafter. Since no limit applies to the L_{WAd} of this equipment, a possible noise reduction of this equipment with technical progress depends on market forces. In contrast to Art. 12 equipment, a “self-certification” of the product by the manufacturer is possible. The “internal control of production” (Annex V, OND) does not involve a NB.

2.2 Machinery Directive

If more than one Directive applies to a product, the EC declaration of conformity shall list all applicable Directives and the product must be compliant with all of the listed Directives. However, ESHR 1.7.4.2(u) of

the MD, demanding a noise emission declaration in the instructions, allows for an exception of this approach: “Where specific Community Directives lay down other requirements for the measurement of sound pressure levels or sound power levels, those Directives must be applied and the corresponding provisions of this section shall not apply”(MD, Annex I Sec. 1.7.4.2(u)). Thus, regarding the sound power level, manufacturers of outdoor equipment within the scope of the OND must follow the approach, described in Sec. 2.1. However, the OND does not lay down any requirements for the measurement of the emission sound pressure level L_{pA} , so it has to be measured and declared following the requirements of the MD.

It has to be provided as a dual-number declaration: the emission sound pressure level L_{pA} and its uncertainty K_{pA} . Furthermore, the measurement method and the operating conditions have to be specified. This can either be achieved by a complete documentation of the measurement method and the operating conditions, by reference to a B-standard (e.g. EN ISO 11202) and a specification of the operating conditions or by reference to a C-standard (machine specific safety standard or noise test code). The voluntary application of standards under the MD can decrease comparability of noise emission data of different machines. These data can only be compared if they were measured using the same standard.

In contrast to the OND, the noise requirements of the MD are not limited solely to noise information. Sec. 1.5.8 in Annex I of the MD obligates manufacturers to design their machines “... 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.” However, it is difficult, if not nearly impossible, for market surveillance authorities to check, whether a machine meets this requirement. As a result, the reduction of noise emissions of machines under the MD depends mainly on market forces despite this requirement. The latter, in turn, depend on reliable and comparable noise emission data.

3 STRATEGIES TO SELECT QUIETER OUTDOOR EQUIPMENT

3.1 Compare the guaranteed sound power levels

The first and easiest step is to compare the guaranteed sound power levels L_{WAd} of the equipment, suitable for your application. They have to be labelled on the product following the provisions of the OND. However, be aware of the problems, discussed in Sec. 4.

3.2 Discover the limit value

Buyers should check the limit values listed under Article 12 of the consolidated version of the OND. If a limit value applies to the equipment to be purchased, it is likely that many products will be labelled with this limit value. A first hint at a quieter choice would be a product labelled at least 3 to 5 dB(A) below the limit value. If all possible choices are labelled with the limit value, it might be the case that there is no quieter choice or that the manufacturers or the NBs, respectively, add a different uncertainty to the measured sound power level, e.g. due to different product variations resulting from production. Check the EC declaration of conformity for the measured sound power level. The lowest measured sound power level might hint at the quietest product available. However, only the labelled sound power level is guaranteed, so be sure to compare the emission sound pressure level in the instructions as well (see Sec. 3.3).

3.3 Compare the emission sound pressure levels

The L_{pA} has to be declared in the instructions and sales literature containing performance data. The advantage is that, in contrast to the guaranteed sound power level L_{WAd} , which may contain different uncertainties, the measured quantity (L_{pA}) and its uncertainty (K_{pA}) are given. Due to the voluntary nature of standards under the MD and revisions of standards, it is important to make sure that the emission sound pressure levels to be compared were measured using the same standards and operating conditions.

3.4 Compare equipment with different power sources

If available, it is worth to compare combustion engine powered, mains powered and battery powered equipment. The performance of battery powered equipment becomes more and more comparable to mains or combustion engine powered equipment, whereupon combustion engine powered equipment is usually the noisiest option.

4 PROBLEMS FACED IN PRACTICE

4.1 Limit values hindering competition

Of the 14 lawn mowers (limit value 96 dB(A)) studied in Ref. (13), only 4 (28,6%) were declared at least 4 dB(A) lower than the limit value. The measurements revealed that 6 lawn mowers (43,9%) had a sound power level below 90 dB(A). Among 11 lawn trimmers none was declared more than 2 dB(A) below the limit value. 10 motor hoes, tested in the same study, were all declared at the limit value of 93 dB(A). Thus, it seems that limit values do not promote competition towards quieter equipment. They merely represent a legal requirement, so manufacturers might simply aim at reaching this minimum in terms of low noise emissions.

Furthermore, as described in Sec. 2.1.1 these limits have not been decreased for more than a decade. For those 11 types of equipment, where it was deemed not technically feasible to lower the limit value in January 2006, they have not been decreased for more than 15 years.

However, there is evidence that even this minimum standard, set more than 10 years ago, is not adhered to by all manufacturers (see Sec. 4.3 and Ref. (13)).

4.2 Span of uncertainty

Whereas the NBs have suggested a method to determine the uncertainty in a Reference for Use (RfU)(14), this does not seem to be used for all the equipment subject to noise marking only, where a NB does not have to be involved. In the sample of leaf blowers, investigated in Ref. (13), the maximum difference between the labelled and the measured A-weighted sound power level was 7 dB. From the studied equipment, one could, at the worst, compare two leaf blowers, select the one with the lower guaranteed sound power level and end up with the louder product.

Furthermore, the NBs suggest unrealistically low standard deviations of reproducibility σ_R , e.g. 0,5 dB for determining the L_{WA} of a dozer driving through a hemispherical measurement surface with a radius of 4 m(14). Although the RfU can ensure a “level playing field” for manufacturers and prevent unwanted competition between NBs for the most lenient approach regarding uncertainty, the low uncertainties assigned to the measurement method weaken the effect of the noise limits of the OND. These values are “... based on the experience of European Notified Bodies ...”(14), although it is admitted that “... generally verification by round robin test is considered to be desirable.”(14) The average suggested σ_R are 0,55 dB for Art. 12 equipment and 0,65 dB for Art. 13 equipment, whereas this quantity is 1,5 dB according to EN ISO 3744(15, Table H.1), which most measurements for the OND are based on.

4.3 Non-compliant equipment - market surveillance?

BAuA checked the declared noise emission data of different types of outdoor equipment(13). Whereas all studied lawn mowers were compliant with the requirements of the OND, three lawn trimmers (about 27%) and six motor hoes (70%) exceeded the respective limit value(13). The situation was slightly better for the studied leaf blowers, where only 3 out of 20 machines (15%) exceeded their guaranteed sound power level. These findings suggest that increased efforts by market surveillance authorities are in order.

5 PROBLEMS OF MANUFACTURERS

The lack of market surveillance (see Sec. 4.3) can be a disadvantage for those manufacturers, who obey the law and produce and sell compliant equipment. Even though in order to place Art. 12 equipment on the market a

NB has to be involved, this does not guarantee that all products of a certified model on the market will be compliant (see Sec. 4.3). The situation could probably be worse for Art. 13 equipment, where the involvement of a NB is not required.

5.1 Outdated standards

All of the 14 European and international standards, referred to in the OND, have been withdrawn or amended(8). However, to ensure conformity with the OND manufacturers have to use exactly the version referenced in the OND. If that is not the same version or the same standard as the one harmonised under the MD, manufacturers sometimes have to repeat similar, but yet different measurements to comply with the requirements of both Directives, e.g. the example of chainsaws discussed in Ref. (13).

5.2 Identifying the appropriate standard

Whereas the OND makes clear references to certain standards, the application of standards is voluntary under the MD. Due to the large number of different types of machines covered by the MD, it can be difficult for a manufacturer to identify the appropriate standard. In order to find a standard in the Official Journal of the European Union one has to know the exact name for the type of the machine used in the title of the standard.

6 PROPOSALS TO IMPROVE THE SITUATION

Although several studies on the implementation(16), the current scope and limit values(17) as well as a possible merger of the OND with the MD(7) have been conducted, this Directive has yet to be revised. Whereas in the recent public consultation several manufacturers suggest to allow “self-certification” (Annex V in the current OND) also for Art. 12 equipment, many stakeholders, concerned with environmental noise, oppose such a change. However, there are further proposals on which consensus might be reached:

6.1 Strengthening market surveillance

If the compliance of outdoor equipment is not checked regularly by market surveillance authorities, loud outdoor equipment, partly even exceeding the limit value or its guaranteed sound power level, will remain on the market. However, noise emission tests of outdoor equipment are costly and have to be conducted on the Member State level. Due to the large number of importers and the practice of rebranding - selling products from another manufacturer under one’s own brand or company - it is difficult to ensure that all outdoor equipment on the market complies with the requirements of the OND and the MD, respectively. Nevertheless, regular market surveillance actions targeted at noise should improve the situation.

6.2 Noise emission classes

Assigning a class to the level of noise emissions from a certain type of outdoor equipment, as proposed in Ref. (18), might increase the noise awareness of consumers as well as professional users, employers, etc. A label displaying the noise emissions compared to other noise emission classes would enable consumers to rank a number, otherwise often perceived as “meaningless”, such as the currently labelled guaranteed sound power level. Furthermore, the success with the EU energy label (see Ref. (19)) suggests that this, in turn, will provide the right incentive for manufacturers to achieve a better noise emission class.

6.3 Incentives to employ market forces

Programmes on EU level to sponsor and support the purchase of quiet outdoor equipment, especially by cities and municipalities, might provide an effective incentive for manufacturers to develop and sell such equipment. However, this will not address consumers and a long-term programme will come with high costs. Another incentive might be an EU-label for environmentally friendly, quieter outdoor equipment. Once the public sector would make such a label mandatory for their suppliers, manufacturers would aim to meet its requirements.

6.4 Improve the alignment of the OND and the MD

Updating the references to standards to those currently listed under the MD, e.g. for chainsaws from ISO 9207:1995 to ISO 22868:2011, and introducing a procedure to update these references regularly, while ensuring that the noise limits are not undermined by changes to the measurement method, will reduce the measurement efforts for manufacturers and NBs, since the repetition of similar, but yet slightly different measurements will be avoided. Furthermore, it will ensure that the measurement methods used to determine the guaranteed sound power level will be state of the art.

6.5 Impose limit values on more types of equipment

The ODELIA study proposes the introduction of noise limits for additional 28 types of equipment(17). Although measurements(13) suggest that limit values are not always adhered to, they are usually based on some kind of comparative emission data (the noise database(10) despite its problems in the case of the ODELIA study) and thus ensure a certain minimum standard regarding the level of noise emissions. If the limit values would be lowered regularly, as intended already by the current OND, and market surveillance would be strengthened significantly, limit values could be a viable option to reduce the noise emissions, at least for outdoor equipment. The tendency to declare products simply with the limit value might be dealt with by introducing a defined and mandatory method to determine the uncertainty in the revised OND.

7 CONCLUSIONS

The noise requirements of the MD and the OND are a reasonable approach to deal with the noise problem and should ensure that employers can identify quieter choices of outdoor equipment, at least in theory. However, in practice the interplay of the two Directives sometimes may result in confusion of both users and manufacturers. Nevertheless, the lack of market surveillance, which ensures compliance with the requirements of the Directives, and of real incentives to buy quiet transpired to be the bigger issue. Noise emission classes, as suggested in Ref. (19), might increase the awareness of noise among consumers as well as professional users and thus provide incentives for manufacturers to develop, produce and sell quieter outdoor equipment. In the end this might prove more feasible and effective than increased efforts by market surveillance authorities.

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