

Technical Note

The “NOMAD” Project – A Survey of Instructions Supplied with Machinery with Respect to Noise

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The NOMAD project was a survey to examine the noise-related content of instructions supplied with machinery offered for purchase in Europe. The project collected more than 1500 instructions from machines covering 40 broad machine-families and from 800 different manufacturing companies. These instructions were analyzed to determine compliance with the requirements of the Machinery Directive, and assess the quality of information.

The general state of compliance of machinery instructions with the noise-related requirements of the Machinery Directive was found to be very poor: 80% of instructions did not meet legal requirements. Some required numerical values relating to noise emissions were often missing. Where values were given, they were often not traceable to machine operating conditions or measurement methods, and not credible either against stated conditions/methods or as warnings of likely risk in real use.

As a consequence, it is considered highly likely that, in making a machinery procurement decision, employers are prevented from taking noise emissions into account, and understanding what is necessary to manage the risks from noise relating to equipment that is procured.

Recommendations are made for actions aimed at bringing about a global improvement to the current situation. Targeted actions are now proposed by “ADCO Machinery Group” aimed at raising awareness of the legal requirements, responsibilities and actions required among the various groups who have parts to play in the system – machine manufacturers, machine users, occupational safety and health professionals, and standards-makers. Recommendations are also made aimed at providing, or improving, tools and resources for all these actors.

Keywords: noisy machine, machinery directive, legal requirements, survey.

1. Introduction

1.1. Noise control at source and “buy quiet” strategy

Reducing workers noise exposure is, as for the other risks, ever more efficient when acting at the source. Acting at the noisy machinery, and at the design stage, must be the chosen solution as said by the European so-called “Machinery Directive” (Directive 98, Directive 2006) in which “*essential health and safety requirements in relation to design and manufacture in order to improve the safety of machinery placed on the market*” are detailed.

Manufacturers (or importers) of machinery sold in the European Economic Area must provide values of

sound emission of the machinery in the instructions. Then, users of noisy equipment should be able to compare the different products available for purchase and really reduce the risks at source by “buying quiet” (KURTZ, JACQUES, 2011).

Furthermore, risk evaluation by the employer, as required by legislation (Directive 2003) can be based also on the “*information on noise emission provided by manufacturers of work equipment (...)*”. Quality of information on noise emission is then a key element allowing regulation to work for improving the prevention of risks.

In this context, NOMAD (“Noise Machinery Directive”) aimed at assessing the quality of information on noise emission provided in the machinery instructions.

1.2. Legal requirements relating to noise in the Machinery Directive

The European Machinery Directive (89/392/EEC, 98/37/EC and 2006/42/EC) was introduced to enable free trade and consistent standards of safety across Member States and European Free Trade Agreement (EFTA) countries. The Directive contains essential health and safety requirements (EHSR) relating to a range of health and safety risks arising from the use of machinery at work.

In relation to noise, the Machinery Directive (2006/42/EC) places an explicit duty on machine manufacturers and suppliers to:

- design and construct products in such a way that the “risks resulting from the emission of airborne noise are reduced to the lowest level taking account of technical progress and the availability of techniques for reducing noise, particularly at source” (EHSR 1.5.8);

with further explicit requirements that the instructions accompanying machinery must contain:

- information on noise emissions (numerical values) (EHSR 1.7.4.2u); and
- instructions on installation and assembly for reducing noise and vibration (EHSR 1.7.4.2j).

The Machinery Directive has other requirements relating to the content of instructions that apply to all hazards, including noise. The main requirements that can be applied to noise in relation to instructions are that they must contain:

- instructions for safe use and necessary training of operators (EHSR 1.7.4.2k);
- information on residual risks (EHSR 1.7.4.2l); and
- instructions on protective measures for the user, including appropriate Personal Protective Equipment to be provided (EHSR 1.7.4.2m).

The main purpose of NOMAD was to assess the information provided in machinery instructions (relevant to noise as a hazard) against these legal requirements.

The purpose of providing warnings, risk information and noise emission information is to allow manufacturers to demonstrate low-noise designs; and to allow purchasers and users of machinery to make informed choices regarding the safety of a potential purchase and to understand what measures will be necessary to mitigate the risk in real use.

1.3. NOMAD survey objectives and steering

NOMAD project involved the collection of machinery instructions, extraction and storage of relevant data from these instructions, and systematic analysis (qualitative and quantitative) of the data to determine legal compliance and quality of information. The work

was supported by the Administrative Co-operation Group for Market Surveillance under the Machinery Directive (“Machinery ADCO”) and involved contributions from 14 European Union (EU) and European Free Trade Association (EFTA) Member States.

The project was overseen by a Steering Committee, with practical contributions being managed by representatives of individual Member States. The Steering Committee included members from Finland, France, Germany, Poland, Spain, The Netherlands and the United Kingdom.

2. Survey methodology

2.1. Data collection

Several sources were used for obtaining the machinery instructions. The main sources were:

- Manufacturers/Importers (directly or via web sites);
- Final users;
- Existing databases built up for other purposes.

Depending on the individual contributing Member State, instructions were either collected for specific types of machine, or without any specific machine-type in mind. As a matter of policy, only instructions from machines first put on the market from 2000 onwards were collected.

The total sample of instructions included in the final analysis (i.e. excluding those assessed as unusable for analysis) was 1530. This covered 40 broad categories of machinery, and several hundred different manufacturers.

2.2. Data analysis

Two types of information were extracted:

- Those allowing the identification of the machinery (type, family, model, manufacturer, country, does the machinery fall within the scope of Annex IV of the Directive? Does the machinery fall also within the scope of Directive 2000/14/CE? (Directive 2000), etc.),
- Those connected to noise emission and associated risks: Table 1 displays the main information which must be clearly provided in conformity with the Machinery Directive.

The methodology for deciding whether a piece of instructions conformed to legal requirements is described in the full NOMAD Report (NOMAD Report, 2012). From replies to a set of key questions, instructions were categorized as shown in Table 2.

Table 1. Information on noise mandatory in the instructions.

Information on noise	Role in prevention and risk management
1. Emission sound pressure level at workstation (continuous sounds) L_{pA} dB(A) if > 70 dB(A)	Allows assessment of noise exposure of the worker knowing work duration and other environmental parameters (place, other sources, ...)
2. If emission sound pressure level ≤ 70 dB(A) this fact must be indicated	In this case, manufacturer guarantees that the machinery is “not really noisy”
3. Maximal emission sound pressure level (impulsive sounds) at workstation $L_{pC,peak}$ if > 130 dB(C)	The same as 1 but for impulsive noise (shocks)
4. Emission sound power level L_{WA} if $L_{pA} > 80$ dB(A) <i>Previous Directive 98/37/CE – less severe – indicated > 85 dB(A)</i> Always mandatory if machinery falls in the scope of Directive 2000/14/CE (Directive 2000)	In this case, the machinery is rather very noisy. Manufacturer is required to measure all the acoustical energy emitted (in the total space around and not only to the workstation). This number allows easy comparison between the emission levels of different machinery. It allows also to calculate noise levels in the environment where the machinery operates
5. Uncertainties in measurement of L_{pA} et L_{WA} <i>Not mandatory in Directive 98/37/CE</i>	Relative to 1 and 4, they show the measurement quality
6. Type-B standard or manufacturer’s own general method of measurement	Relative to 1 and 4, this information insures traceability of noise emission values to general measurement methods. It shows also quality and credibility of declared values
7. Noise test code used or manufacturer’s own particular method of measurement	Relative to 1 and 4, this information insures traceability of noise emission values to a noise test code specific to the machinery. It shows also quality and credibility of declared values and allows: <ul style="list-style-type: none"> • the user to know what are the working conditions of the machinery when the measurements are carried out • declared values to be verified, if needed
8. Warnings about risks that have not been eliminated and which the user will need to manage, i.e. residual risks	Qualitative information required for the user who must operate the machinery with reduced risks
9. Instructions for safe use and necessary training of operators	
10. Information on residual risks	
11. Instructions on protective measures for the user, including appropriate Personal Protective Equipment to be provided	
12. Description of adjustment, maintenance and preventive maintenance requirements	

Table 2. Categorization of instructions.

Conformity	Final assessment	Meaning
COMPLIANT WITH THE DIRECTIVE	A Correct	Correct information, very clear and useful for final user
	B Good enough	Some correct information, some lacks or missing information not too risky for final user
NOT COMPLIANT WITH THE DIRECTIVE	C Inadequate	Some correct information but one or several reasons for non compliance
	D Very poor	No information or unusable information

3. Results

Results show that the content of the instructions analyzed is incomplete or wrong relatively to the essential requirements on noise of the Directive: 80% of them do not meet these legal requirements (cf. Fig. 1).

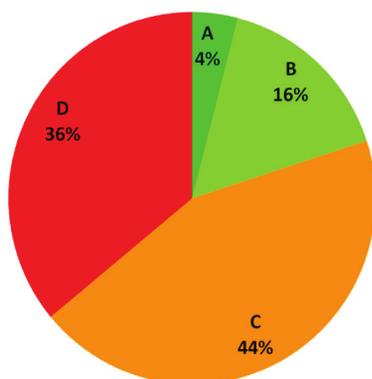


Fig. 1. Distribution of instructions in the 4 categories (A – correct; B – good enough; C – inadequate; D – very poor).

Some of the numerical values, or all of them, can be missing. Furthermore, when values are given, they cannot always be linked to operating conditions of the machinery or to measurement methods.

There is not one reason for non-compliance which is more important than others: instructions were often found to be not compliant for a combination of reasons. Lack of traceability and lack of credibility of the declared numerical values are often present in most of non-compliances. Lack of information on residual risks or safe use of the machinery appears very often for the instructions classified in the worst category (D).

Other results are, among other things:

- 12% of the instructions analyzed do not display any piece of information on noise.
- 27% display some information about noise but no required numerical values.
- 4 instructions out of 10 displaying numerical values are not compliant.
- 75% of instructions displaying numerical values do not allow the traceability of these values.
- When credibility (relative to operating conditions and/or measurement methods and/or real conditions of use) of the numerical values could be assessed, 64% of the non-compliant instructions were found not to be credible.
- Where instructions for safe use or residual risk information were assessed, 51% of non-compliant instructions lacked information about residual risks.
- 32% of non-compliant instructions where quantitative values were given contained incorrect noise terminology.

- Instructions were often found to be not compliant for a combination of reasons. Of the 1244 non-compliant instructions, 22% show only one single reason for failure.

The situation is not significantly better for machinery covered by Annex IV of the Machinery Directive. This suggests that the involvement of Notified Bodies in the compliance procedure has negligible effect on noise declaration.

No significant difference was noticed for machines also covered by the Outdoor noise directive 2000/14/CE. This result suggests that the requirement for a manufacturer to consider an additional Directive specifically relating to noise has negligible effect on his approach to the provision of information on noise in relation to the Machinery Directive.

4. Discussion

Reasons that are likely to explain this situation are: (i) lack of knowledge among machine manufacturers about legal requirements, machinery safety standards or noise test codes, technical issues around noise or technical know-how in applying noise test codes, and (ii) lack of care among machine manufacturers, caused by the lack of commercial incentive to comply (quieter machines or those with better instructions not gaining market share), no fear of enforcement action and/or reputational harm, or simply that noise and damage to hearing is not considered a significant risk.

A large proportion of users/purchasers of machinery are likely to take quantitative noise emission information at face value; they are unlikely to check the traceability details, and may not have the knowledge to judge credibility. Therefore it is considered that the manufacturer has a significant responsibility to ensure that the emission values either can be taken at face value as a means to compare machines and describe likely risks, or are accompanied by clear warnings if either of these is not the case.

As a consequence of the survey results, it is considered highly likely that, in making a machinery procurement decision, employers are prevented from taking noise emissions into account, and are prevented from understanding what is necessary to manage the risks from noise relating to equipment that is procured.

5. How to improve the situation?

To improve the situation, targeted actions (that are achievable on a large scale, can be carried out within existing frameworks and are expected to have measurable outcomes) are foreseen.

Actions aimed at manufacturers: large campaign of information, promotion and enforcement to raise manufacturers' awareness of the noise aspects

of European regulations (both directives 2006/42/CE and 2000/14/CE), their responsibilities and the resources that are available to support them.

Actions aimed at final users and purchasers: large campaign of information to raise final users' awareness of their responsibilities and the available resources to support them and to promote a "buy quiet" strategy highlighting the advantages, for employers, to purchase less noisy machinery.

Actions aimed at public authorities: targeted market surveillance, in a few sectors, aimed at technical sales literature. The latter, easier to get than the instructions, have to display, since December 2009, the same noise information as instructions.

Actions aimed at standardization organizations: to make them more aware of the basic role of noise test codes regarding traceability of noise emission values.

Actions aimed at Notified Bodies: to clarify their duties regarding noise and to make sure that competences required are present.

Actions aimed at occupational safety and health organizations: to ensure that they play efficiently their key role of technical risk reduction interface between the various actors.

6. Conclusion

NOMAD survey has shown that instructions are, for the largest part, not in compliance with current noise legislation. As a consequence, final users and purchasers of machinery do not have the information necessary to manage the noise risk from the data that should be provided by these instructions.

The improvement of this situation requires a variety of actions aimed at all major actors who all bear some responsibility for this situation. NOMAD survey reveals the knowledge gap between experts in acoustics and machinery manufacturers. To bring the two parties together, there are two not mutually exclusive solutions i.e. to increase the knowledge of machine manufacturers and to simplify the noise risk display. Joint efforts of those who know too much (acousticians) and those who should know more (all other actors contributing to noise reduction at the workplace) are necessary to make the "Buy Quiet" attitude a reality. Progress requires innovative tools to be designed

such as simple and easy-to-understand noise indices, color scales as it is currently done in the environmental field (MIETLICKI, 2012).

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