STANDARDS ON MACHINERY NOISE NEEDED TO SUPPORT EUROPEAN COMMUNITY DIRECTIVES

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1. INTRODUCTION

European Community Directives intended to remove technical barriers to trade are formulated within the Commission and approved by the Council of Ministers, following which they are implemented through legislation in each of the member states. They apply to all goods marketed within the Community, no matter where in the world they are manufactured. Directives published up to around 1985 and already in operation, and a few later ones derived from them, include several specifying limits on the noise emitted by individual machine types. These earlier Directives quote maximum noise emission levels related to the size or power rating of the machines, and they contain annexes with all the details of the methods of test. Current (so–called "New Approach") Directives, produced as part of the effort to complete the Single European Market, include only a statement of essential requirements. Techniques for demonstrating compliance with these requirements are then given in European (EN) Standards, produced by the Comité Européen de Normalisation (CEN). Two such Directives [1,2], covering the safe operation of a wide range of machinery, will come into operation in 1993. These refer to risks arising from noise emission, as well as to other safety hazards, and CEN Technical Committee 211 (Acoustics), in co–operation with ISO Technical Committee 43, has established a programme of work to produce standards generic to all types of machinery, which address the noise requirements of these Directives. A large number of other CEN Technical Committees, responsible for standards on particular machinery types, have the task of producing machinery–specific standards, taking the generic standards as a basis. This paper summarises the response of the international standards organisations to these European legislative requirements relating to noise emission.

2. MACHINERY DIRECTIVES

2.1 General

The later Directive, 91/368 [2], amends and serves primarily to extend the scope of the earlier one, 89/392 [1]. Between them they apply to most devices which can be described as machinery, both those which are stationary and those which are mobile in operation, and including machinery for lifting. The major exceptions are machines which would more generally be described as means of transport, though there are other special exceptions also.

The requirements of the Directives are addressed to the manufacturers of machinery, rather than

to purchasers or operators. Essential Safety Requirements are given, whereby the normal use of the machinery has to be envisaged and steps taken to prevent abnormal use; risks from the use of the machinery have to be eliminated in the design, or at least reduced to the minimum; protective measures have to be taken regarding the remaining risks; and information has to be given on the need for training of operators or the provision of personal protection. Each of these factors is discussed in the Directives in relation to the different hazards which might occur in the use of machinery. When they come into operation, manufacturers will have to make a declaration of conformity with the requirements and mark permanently all machinery of the type concerned with the EC mark.

To demonstrate conformity, reference may be made to published standards indicating particular safety criteria and methods of test. These standards can be harmonised European ones or, lacking these, suitable national standards which have been declared for the purpose can be used. CEN and ISO have agreed to work closely together in production of the large number of safety standards needed to cover all the types of machinery involved.

2.2 Noise Requirements

The stated requirement for noise is that the machinery must be designed and constructed so that risks resulting from noise emission are minimised, taking account of the availability of means of reducing noise at source. Further, it is required that the instructions for the machinery give information on the sound pressure levels at work stations, the sound power level if the sound pressure level at work stations exceeds 85 dB(A), and on the methods and operating conditions used for noise measurements.

It is interesting to note, in the context of interpreting these requirements for purposes of producing standards, that there is no indication that the Essential Safety Requirement for noise might be expressed in the form of a noise emission limit. Also, the opinion of the Commission of the European Communities has been expressed that the information on noise given in the instructions should be representative of normal use of the machinery at a typical workplace, in a realistic acoustic environment [3].

3. INTERNATIONAL AND EUROPEAN STANDARDS UNDER DEVELOPMENT

Within CEN a hierarchy of standards has been established, comprising type A standards giving basic concepts and principles for design applicable to all machinery, type B standards dealing with one safety aspect (such as noise) across a wide range of machinery, and type C standards giving detailed requirements for a particular type of machinery. In view of the existence of a large body of International Standards on noise emission, CEN TC 211 sought the co–operation of ISO TC 43 in preparing type B standards needed to implement the noise requirements of the EC Directives. These will deal with low–noise design of machinery and workshops, measure–

ment of the performance of noise-attenuating devices, measurement and determination of sound pressure levels at positions around machinery, and determination of sound power levels of machinery.

In many cases, the new standards are being developed through revisions of existing standards, but there were no standards dealing with low-noise design and TC 43 set up three new working groups to prepare these. Up to the present time, drafts have been circulated giving recommended practices for the design of low-noise machinery (the ISO 11688 series) and for the design of low-noise workplaces (the ISO 11690 series). With the long-term aim of quantifying the state of noise control technology of machinery groups, a draft standard has also been circulated describing means of systematic collection and comparison of noise emission data (ISO 11689). With regard to the determination of the acoustical performance of noise attenuating devices, drafts have so far been circulated on the sound insulation of enclosures (the ISO 11546 series), on the insertion loss of ducted silencers (ISO 11691), and on the sound insulation of cabins (ISO 11957).

ISO 6081 at present gives guidance on the measurement of sound pressure levels at the operator's position of machinery, but its scope is too limited to be useful across a sufficiently wide range of machinery types for the purposes of the Directives. It will therefore be superseded by a new series of standards, the ISO 11200 series, in five parts, now in preparation. These will define a quantity termed the emission sound pressure level, to make it clear that they refer only to the sound emitted by the machinery under particular conditions, and not to the noise exposure of an operator during a working day. The first part will serve as a guide to the remaining four, and the latter will comprise a method of measuring emission sound pressure levels in hemi-anechoic acoustic conditions (ISO 11201); two measurement methods for use with the machinery in situ, one with a rather crude environmental correction (ISO 11202) and the other with a more involved but more accurate environmental correction (ISO 11204); and two alternative methods of calculating emission sound pressure levels from the sound power level (ISO 11203).

The ISO 3740 series of standards, at present in eight parts, gives a variety of methods of determining the sound power level from measurements of sound pressure level. These standards date back to the 1970s and experience in using them has enabled a number of deficiencies to be identified. A major revision has therefore begun, concentrating first on the most widely used parts in the series. The existing ISO 3743, giving a method for use in "special" reverberation rooms, will be re-issued unchanged as Part 2 of the same standard, and a new Part 1 will shortly be published giving a comparison method for small portable machines in hard-walled test rooms. The numbers ISO 3744 and ISO 3746 will be retained, but completely revised standards are being prepared, both employing an enveloping measurement surface, the former for use in hemi-anechoic conditions and the latter to be applied with the machinery in situ. The new draft of ISO 3744 has now been finalised, and a further draft of ISO 3746 is about to be

circulated.

ISO 9614 is a new standard to be issued in two parts, giving methods for determining the sound power level from sound intensity measurements. Part 1, describing measurements made at discrete positions, has been finalised, and the first draft of Part 2, in which the sound intensity probe is scanned around the machinery, is expected to be circulated shortly.

ISO 4871 at present covers noise labelling of machinery, but it is inadequate for the circumstances that will exist under the Directives. Manufacturers will have to declare noise emission levels which might at some stage need to be verified by a user or an authority, and the levels will be subject to a degree of measurement uncertainty. The extent of the uncertainties varies with the measurement method, and some data on this are included in the standards described above. The declaration and verification of noise measurements is covered in detail in ISO 7574, but a simplified approach which should be adequate for most practical cases will be given in a completely new version of ISO 4871.

The type C standards will mostly be produced by the respective technical committees dealing with the individual machinery types. Around 30 CEN committees are known as having potentially to deal with noise, and in order to assist them in achieving conformity with one another in the hundreds of standards which will eventually be produced, CEN TC 211 and ISO TC 43 are preparing yet another type B standard giving guidance on the preparation and contents of noise test codes. This will be ISO 12001. A consequence of the production of the latter is that it brings into question the need for and the content of the existing standard acting as a guide to International Standards on measurement of airborne noise, ISO 2204, and ISO TC 43 is now looking closely at this standard before coming to a decision on its future.

4. POINTS FOR DISCUSSION

In discussing type C standards on noise emission, some machinery technical committees have questioned whether or not they should include noise limits for their types of machinery, or at least some guidance on the lowest noise levels that might be achievable in the present state of technology. The argument in favour is that a statement of the noise levels to be achieved would enable machinery manufacturers to set design goals which would be regarded as satisfying the Essential Safety Requirements of the Directives. This is a complex issue, which in some quarters is regarded as unsuitable for standardisation. Authoritative opinions are awaited from the European Commission and the CEN Technical Board, but some technical committees are moving towards the position of setting "minimum achievable noise levels" for specific types of machinery [4], as part of a long-term aim to define "maximum permissible noise levels".

It has also been questioned whether it is possible to establish a "scale factor" for inclusion in

the standards, by which to adjust noise emission values obtained in laboratory conditions and so to yield operator noise exposure levels approximating to real-life working conditions. The European Commission has expressed a wish, as mentioned above, for measurement methods to yield noise levels representative of typical use of the machinery, in a likely work situation. Some of the standards in preparation by ISO TC 43 are intended to be applied in situ, and environmental corrections are included. However, the types of machinery to which the standards are applicable, and the conditions under which they are used in practice, are so diverse that so far it has not been thought possible to develop a scale factor of the kind envisaged.

5. REFERENCES

[1] Council Directive of 14 June 1989 on the approximation of the laws of the Member States relating to machinery, 89/392/EEC. OJ No L 183, 29.6.1989, 9–32.

[2] Council Directive of 20 June 1991 amending Directive 89/392/EEC on the approximation of the laws of the Member States relating to machinery, 91/368/EEC. OJ No L 198, 22.7.1991, 16–32.

[3] M J van der Venne, "The EEC and the control of noise at work", Proceedings IMechE, C406/038 (1990).

[4] A E Shenton, "Woodworking machines CEN/TC 142", CEN TC 211 Seminar on Standards for Machinery Noise, 26 February 1992.