

# Noise risk as described in instructions supplied with printing machinery

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The printing industry uses a wide range of noisy machines that have the potential to damage workers' hearing if the risks are not effectively managed. Users need information that represents noise emissions during the intended uses of the machine, to enable an assessment and the management of the associated noise risks.

There is a legal requirement under the Supply of Machinery (Safety) Regulations 2008 for machinery manufacturers to provide declared noise emissions in instruction manuals. (This legislation implements the EU Machinery Directive 2006/42/EC). However, there is a lack of information on the adequacy of declared noise emissions for printing machinery sold in the United Kingdom.

This report describes research that was carried out to assess the adequacy of the noise emission information provided in a sample of fifteen instruction manuals supplied by manufacturers of printing machinery. The study found that the noise content in the majority (approximately 75%) of the instructions gave declared noise emission information that would help the user assess and manage real use noise risks. However for 25% of the instructions, the noise emission information was either incorrect or not machine-specific. Additionally, none of the instructions provided information on the uncertainty associated with the measured noise emission values; this is legally required.

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# Noise risk as described in instructions supplied with printing machinery

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## **KEY MESSAGES**

Noise information collected across the printing industry by the Health and Safety Executive (HSE) suggests that high noise levels are still observed, although there has been a reduction in the noise levels and exposure levels over the last 30 years.

The Machinery Directive 2006/42/EC requires machinery manufacturers to minimise noise risk and provide noise information in the machine's instructions. This information must inform users of any residual noise risk and enable them to put in place control measures so that the machinery can be used without risk from noise.

An assessment of the noise-related content of instruction manuals for printing machinery against the Machinery Directive 2006/42/EC noise requirements showed that the majority contained noise emission values that were credible as an indicator of real use risk.

The approach to writing standards for printing machinery has been to have machinery operating under realistic conditions during standard noise tests; this has produced noise emission data representative of real use noise levels.

The noise information provided in printing machinery instruction manuals can help the user assess and adequately manage the noise risk.

## EXECUTIVE SUMMARY

There are safety standards and noise test codes for printing machinery. These were assessed along with the declared noise emission information obtained by the Health and Safety Executive (HSE) during a noise survey carried out in the printing industry between 2010 and 2011. The purpose of the assessment was to:

- Review the noise-related clauses within the safety standards for printing machinery to identify what manufacturers are required to do, with regard to measuring and reporting machinery noise.
- Assess the noise emission information provided with printing machinery against the noise-related requirements of the Machinery Directive 2006/42/EC.
- Establish whether the noise emission information provided with printing machinery would enable users to adequately assess and manage the risks from noise.

Harmonised safety standards and a noise test code exist for printing machinery as the EN 1010 series, the EN 1034 series and EN 13023:2003+A1:2010. Compliance with the normative clauses of these standards, within the limits of the scope of the standards, enables manufacturers to demonstrate conformity with the essential health and safety requirements for noise defined in the Machinery Directive.

The parts of fifteen instruction manuals that related to noise were obtained during measurement visits to printing premises during 2010 and 2011. The noise emission information in these instructions was assessed against the requirements of the Machinery Directive. Nine of the fifteen instructions contained noise emission values that were traceable to appropriate harmonised standards or noise test codes and credible with regard to the stated operating conditions.

The operating conditions specified in EN 13023:2003+A1:2010, the noise test code for printing machinery, represent normal use often at 80% of rated speed. It is probable that noise levels will be higher for faster machine speeds. The declared noise emission values in eleven of the fifteen instruction manuals were comparable with real use noise levels measured for the same machines. The declared noise emission data were generally considered to be a reliable indicator of real use risk.

Information on protective measures was included in eleven of the fifteen instruction manuals. This included information on using hearing protection, acoustic enclosures and sound covers. Implementation of these noise control measures was observed in the printing industry.

Residual risk information was not required for eleven of the fifteen machines assessed. However, machine-specific information to help assess and manage real use risk was not provided where the emission data did not reflect real use risk.

Assessing a sample of instruction manuals for machinery currently used in the printing industry, has shown that the majority contain declared noise emission information that would help the user assess and manage real use risk.

This report provides important information; it identifies to manufacturers inadequacies they may need to address and highlights to users the value of the noise information supplied with printing machinery when managing noise risk.

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# 1 INTRODUCTION

The Health and Safety Executive (HSE) collected noise information from across the printing industry between 1985 and 1994. This was followed by a review of the control of noise risk in this industry between 2010 and 2011. A comparison of the two data sets (Shanks, 2013) suggested that there has been a reduction in the noise levels and exposure levels, although high noise levels are still observed; A-weighted noise levels ranged from 81 to 103 dB in the 1985-1994 survey and from 65 to 104 dB in the 2010-2011 survey.

The Machinery Directive 2006/42/EC details essential health and safety requirements (EHSRs) for machinery intended for use at work, which cover a range of health and safety risks including noise. [Note: “Machinery Directive” will be used to refer to Machinery Directive 2006/42/EC throughout this report unless stated otherwise.] Manufacturers are required to design and construct machinery to reduce noise emission at source. They should provide integrated protective measures against noise emission (for example, noise enclosures) and inform users about the residual noise emission allowing them to take the necessary protective measures (for example, through correct installation, workplace design or provision of adequate hearing protection).

Standards have been developed to assist and facilitate compliance with some or all of the EHSRs. Many of these standards can provide manufacturers with a straightforward route to conformity. Harmonised safety standards and noise test codes exist for printing machinery. These were assessed along with the noise emission data obtained by HSE during the noise survey carried out in the printing industry during 2010 and 2011. The purpose of the assessment was to:

- Review the noise-related clauses within the safety standards for printing machinery to identify what manufacturers are required to do with regard to measuring and reporting machinery noise.
- Assess the noise emission information provided with printing machinery against the noise-related requirements of the Machinery Directive.
- Establish whether the noise emission information provided with printing machinery would enable users to adequately manage the risks from noise.

## **2 MACHINERY DIRECTIVE 2006/42/EC**

### **2.1 OBJECTIVES OF THE MACHINERY DIRECTIVE**

The European Machinery Directive 2006/42/EC and its predecessors were introduced to enable free trade and prevent inconsistent standards of safety becoming a barrier to trade within the European Economic Area (EEA). It establishes EHSRs for machinery and these include general and specific requirements regarding noise. The requirements of the Machinery Directive have been implemented into British law by the Supply of Machinery (Safety) Regulations 2008.

### **2.2 REQUIREMENTS OF THE MACHINERY DIRECTIVE**

The Machinery Directive requires manufacturers, suppliers and importers of machinery to:

- Design and construct machinery so that it can be operated, adjusted and maintained without putting people at risk (EHSR 1.1.2) and, for noise, reduce risks from airborne noise emissions to the lowest level taking account of technical progress and the availability of techniques for reducing noise, particularly at source (EHSR 1.5.8).
- Inform users where there are residual risks, despite the inherent safe design measures, safeguarding and complementary protective measures adopted (EHSR 1.1.2 and 1.7.2).
- Provide information, on how to reduce risks from noise, in the instructions accompanying the machinery that includes the following:
  - Instructions relating to the installation and assembly for reducing noise (EHSR 1.7.4.2 (j)).
  - Instructions for the putting into service and use of the machinery and, if necessary, instructions for the training of operators (EHSR 1.7.4.2 (k)).
  - Information about the residual risks that remain after all other protective measures have been taken into account (EHSR 1.7.4.2 (l)).
  - Instructions on the protective measures to be taken by the user, including, where appropriate, the personal protective equipment to be provided (EHSR 1.7.4.2 (m)).
  - Information on airborne noise emissions (EHSR 1.7.4.2 (u)):
    - The A-weighted emission sound pressure level at workstations, where this exceeds 70 dB; where this does not exceed 70 dB, this fact must be indicated.
    - The peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa (130 dB).
    - The A-weighted sound power level emitted by the machinery, where the A-weighted emission sound pressure level at workstations exceeds 80 dB.
    - Whenever sound emission values are indicated the uncertainties surrounding these values must be specified.
- Include the information on airborne noise emissions in the sales literature describing the performance characteristics of the machinery (EHSR 1.7.4.3).

## 2.3 ACHIEVING COMPLIANCE

While the Machinery Directive sets out the mandatory EHSRs, European harmonised standards give detailed technical specifications on how to comply with them. A harmonised standard is a European standard developed by a recognised European Standards Organisation: European Committee for Standardization (CEN), European Committee for Electrotechnical Standardization (CENELEC), or European Telecommunications Standards Institute (ETSI). It is created following a request from the European Commission to one of these organisations. The references of harmonised standards must be published in the Official Journal of the European Union (OJEU) and the harmonised standard must be published by a national body of a Member State. Manufacturers, other economic operators, or conformity assessment bodies can use harmonised standards to demonstrate that products, services, or processes comply with relevant EU legislation.

Harmonised standards are listed according to the relevant Directive and for the Machinery Directive can be found at:

<http://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/machinery/>  
(accessed November 2016)

Application of a harmonised standard can provide manufacturers with a straightforward route to conformity with EHSRs. Where harmonised standards are not available or not applied, conformity with EHSRs must be demonstrated by other suitable methods; for example, noise levels must be measured using the most appropriate method for the machinery. Whenever noise emission values are indicated, the uncertainties surrounding these values must be specified. The operating conditions of the machinery during measurement and the measurement methods used must be described.

When buying machinery, purchasers should look for the CE-marking and the EC Declaration of Conformity. The CE-marking attached to the machinery is a visible sign that the manufacturer of the product is declaring conformity with all of the Directives relevant to the product. The EC Declaration of Conformity provides essential information on:

- The machinery manufacturer or authorised representative.
- The person authorised to compile the technical file.
- The conformity assessment procedure that has been followed and the identity of the Notified Body involved (where appropriate).
- The other Directives that have been applied to cover certain hazards more specifically; for example, Directive 2000/14/EC, which sets out environmental noise emission requirements for machinery intended for use outdoors.
- The harmonised standards or other technical specifications that have been applied (where appropriate).

## 2.4 NOISE-RELATED CONTENT OF INSTRUCTIONS

The Machinery Directive requires that all machinery is supplied with instructions. A European project (referred to as NOMAD – **NO**ise **MA**chinery **D**irective) was carried out between 2009 and 2012, to assess the noise-related content of instruction manuals against the requirements of the Machinery Directive (NOMAD, 2012). The work was supported by the Administrative Co-operation Group for Market Surveillance under the Machinery Directive.

More than 1500 sets of instructions were assessed, covering 40 different types of machinery and from 800 different manufacturers. The assessment showed that 80% of the instructions did not meet the legal requirements with regard to noise, containing inadequate noise emission information. The main failings were:

- Absent or incomplete declared noise emission values.
- Absent or incomplete traceability to operating conditions or measurement methods for declared noise emission values.
- Declared noise emission values were not credible, either against stated operating conditions or as warnings of likely risk in real use.

As a consequence, it was considered highly likely that purchasers and users of machinery would be unable to make informed choices regarding the risks from noise associated with potential purchases or understand what control measures are necessary to mitigate the risks from noise during real use.

The project described here assessed the noise-related content of fifteen instruction manuals gathered by the HSE researchers from printing premises in England between 2010 and 2011; six of these instruction manuals had been assessed as part of the original NOMAD project.

### 3 PRINTING MACHINERY SAFETY STANDARDS

The British Standards Institution (BSI) website was searched to identify standards and noise test codes for machinery used in the printing industry. Two series of safety standards were identified: the EN<sup>1</sup> 1010 series applies to printing and paper converting machines and the EN 1034 series applies to paper-making and finishing machines.

#### 3.1 EN 1010 – PRINTING AND PAPER CONVERTING MACHINES

The EN 1010 series applies to printing machines for printing on paper and similar materials and equipment used in the preparation for the printing process. It also covers machinery used for the handling of paper, products, printing formes (metal templates designed to cut through printing materials) and inks, as well as machinery for cleaning printing formes and checking the print quality. The standard also applies to paper converting machines.

The standard consists of four parts; all are cited in the OJEU. A fifth part is available as a draft for public comment. Noise is identified as a significant hazard for this family of machines. EN 1010-1:2004+A1:2010 contains the common requirements. For noise these are that:

- Machines shall be designed and constructed so that risks from airborne noise emission are reduced to the lowest level particularly by applying control measures at source.
- Noise emission values shall be determined in accordance with EN 13023:2003, which requires measurement of the emission sound pressure level ( $L_{pA}$ ) at the workstation and the sound power level ( $L_{WA}$ ) and the declaration of dual-number values according to EN ISO 4871:2009.
- The instruction manual shall give the declared noise emission values and reference the noise test code EN 13023:2003 and the basic noise emission standards on which the determination of these values is based. The instructions should also include information on the protective measures to be taken by the user, including where appropriate, the personal protective equipment to be provided.

EN 1010-1 contains noise emission data for some types of machinery, which are determined in accordance with EN 13023 and ISO 11689. They are guideline values, intended to provide a general indication of the level of noise that could be generated for a range of printing machinery, for example sheet-fed offset press and collating machines. The data are based on the noise generated by a single machine; they do not take account of combined emissions from multiple sources, the noise from other sources, or sound reflections (for example from the walls, roof). The  $L_{pA}$  values given in EN 1010-1 for sheet-fed offset presses, at both the control desk on the feeder side and at the delivery, are between 78 and 82 dB depending on the working width (ie substrate size).

Parts 2 to 5 of the EN 1010 series of standards cover specific machines, such as printing and varnishing machines, including pre-press machinery and cutting machines. Each part states that noise is dealt with in EN 1010-1. Only EN 1010-4, which applies to bookbinding, paper converting and finishing machines, includes additional information on noise reduction measures. These include providing noise enclosures for sheet folding machines and sound hoods, particularly in the cutting and folding sections. Note: Sound hoods and covers are generally used to reduce the noise from parts of a machine rather than from the whole machine.

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<sup>1</sup> In this report the European reference for standards is given; the BS prefix in the standard number is omitted, for example BS EN 1010 is referred to as EN 1010.

Compliance with the normative clauses of the EN 1010 series of standards, within the limits of the standards, provides a presumption of conformity with the EHSRs of the Machinery Directive.

### **3.2 EN 1034 – PAPER-MAKING AND FINISHING MACHINES**

The EN 1034 series applies to paper-making and paper finishing machines. Noise is identified as a significant hazard for this family of machines. EN 1034-1:2000+A1:2010 contains the common requirements, while significant hazards, hazardous situations and hazardous events relevant to particular machine types are covered in subsequent parts. For noise, EN 1034-1 requires:

- Particular attention to be given to risks from noise at heavy-duty and high-speed machines and machine components. EN ISO 11688-1: 1998 is referenced for general noise reduction measures and examples of specific measures are provided.
- Sound-proof cabins, noise enclosures and sound hoods to be provided if noise reduction at source is not sufficient to avoid health risks.
- Instruction manuals to give information on how to install, assemble and maintain machines to ensure noise emissions are minimised and control measures remain effective.
- Operator training and personal protective equipment to be identified where noise emissions are not reduced to a level at which there is no risk to health.
- Noise emission values to be declared and verified in accordance with EN 13023. However, where the noise test code cannot be applied to large complex machines because they are installed in the user's premises, EN 1034-1 allows the declared noise emission to be based on predictive calculations from:
  - Noise emission data from component parts previously tested.
  - Best technical estimates using archive/historical data from similarly installed machines.
- Instruction manuals to provide noise emission data, including measurement uncertainties, with reference to the measurement methods used and information on personal protective equipment and training requirements.

Compliance with the normative clauses of the EN 1034 series of standards, within the limits of the standards, provides a presumption of conformity with the EHSRs of the Machinery Directive. There are sixteen parts to EN 1034, which cover specific machines such as winders and slitters, paper and board making machines, and sheeters. All are cited in the OJEU.

### **3.3 EN 13023 – NOISE MEASUREMENT METHODS**

EN 13023:2003+A1:2010 defines a noise test code for machinery used in the printing industry. It specifies noise measurement methods and installation and operating conditions to be used for the test. EN 13023 is a harmonised standard, which is cited in the OJEU.

The standard requires the measurement of the emission sound pressure level ( $L_{pA}$ ) at workstations and the sound power level ( $L_{WA}$ ). The standard states that these values permit the comparison of printing and paper machines on the market. For large machines, instead of the  $L_{WA}$ , the standard allows determination and declaration of  $L_{pA}$  values at specified measurement points around the machine. Measurement positions are generally specified at 1.6 m above the

floor or access level and 1 m from the machine surface. Note: “Large machines” as defined by EN 13023 are those where the greatest linear dimension exceeds 15 m.

Operating conditions with significant noise emission are specified in the normative annexes A to J of EN 13023. The annexes cover a range of machines including finishing machines, printing presses and paper converting machines. For each machine, operating conditions (real use) and measuring points at workstations are defined. The operating conditions include speed, substrate size and quality, web width, cutting angle, material feeding, etc. The measurement positions include control desk, delivery unit, feeding unit, winding unit, unwinding unit, etc. For some machine types – paper, board and de-watering machines and coaters – the operating conditions are as agreed between the manufacturer and user.

EN 13023 requires the machine to be assembled and installed in accordance with the manufacturer’s instructions. The test report (which should be kept on the technical file) shall specify the type of installation used for noise measurements, as for some machines the conditions of installation are not known or several modes of installation are possible.

The noise emission values are declared as a dual-number declaration in accordance with EN ISO 4871 and reference should be made to the noise test code and any other standards that have been used.

## **4 NOISE DECLARATIONS AND WORKPLACE NOISE LEVELS**

### **4.1 BACKGROUND**

HSE investigated current noise levels and noise exposure in the printing industry. As part of this project, HSE researchers visited printing premises in England identified through the British Printing Industries Federation (BPIF). The work was carried out between March 2010 and July 2011. During these visits information was gathered to enable a comparison of manufacturers' declared noise emission values and real use noise levels.

### **4.2 DECLARED NOISE EMISSION INFORMATION**

At each site visited, instruction manuals were collected for machinery currently used in the printing industry. Printing machinery is typically complex and the instruction manuals can be very large. Complete instruction manuals were not obtained, but only those parts containing noise emission information. In some cases it is possible that not all the noise emission information from the instruction manual was collected. The noise emission information obtained from the instruction manuals was assessed for compliance against the noise-related requirements of the Machinery Directive.

### **4.3 WORKPLACE NOISE INFORMATION**

At each site visited, measurements were made using logging dosimeters and a sound level meter to determine noise levels at operator positions. These data were used with exposure durations to estimate daily personal noise exposures.

Additional information was also collected at each site on: the acoustic environment, the location of machinery within the site, noise control measures, the use of hearing protection, and the condition of installed machinery.

### **4.4 COMPARISON OF DECLARED AND WORKPLACE NOISE LEVELS**

Table 1 provides a summary of the real use noise levels HSE researchers measured for a range of printing machinery. These real use levels are compared with the declared noise emission values provided by the manufacturers of the same printing machines.

**Table 1: Real use and declared noise emission values for printing machinery**

<b>Machine type</b>	<b>Real use <math>L_{Aeq}</math> dB</b>	<b>Declared noise emission</b>
Inserter	80 – 84	85 dB(A) with vacuum pump 82 dB(A) with silencer cover
Folding machine	80 – 83	<87 dB(A)
Digital sheeter	87 – 89	78 dB(A)
Sheet-fed offset lithopress	80 – 84	81 dB(A) at delivery 83 dB(A) at feeder control console
Rotogravure press A	77 – 83*	85 – 105 dB(A)
Rotogravure press B	73 – 84*	84 – 105 dB(A)
Folding carton gluer	78 – 85	<= 84 dB(A)
Folder gluer	86	80 dB(A) (Slow) at feeding unit 73 dB(A) (Slow) at delivery unit
Die cutter	79 – 84	81 – 85 dB(A) (Slow)
Waste baler	84	<80 dB(A)
Flexo label press	80 – 84	<85 dB(A) – if special equipment used >85 dB(A)
Envelope inserting machine	81 – 86	83 – 87 dB(A)
Web-fed offset lithopress A	84 – 87	80 – 84 dB(A)
Web-fed offset lithopress B	83 – 98	83 – 85 dB(A)
Web-fed offset lithopress C	73 – 100	>85 dB(A)

\*Excludes noise levels at points requiring frequent attendance within the noise enclosure.

## 5 QUALITY OF NOISE EMISSION INFORMATION

The quality of the noise emission information collected for machines, currently being used in the UK printing industry, was assessed against the requirements of the Machinery Directive. The assessment covered:

- Provision of numerical data, including uncertainty data.
- Traceability of numerical data to a measurement method and operating conditions.
- Credibility of numerical data with regard to operating conditions under which they were obtained and as an indicator of real use risk.
- Provision of information on protective measures.
- Provision of information on residual risk.

Uncertainty data were not provided in any of the instruction manuals collected for printing machinery. The Machinery Directive 2006/42/EC was only referenced in one of the instruction manuals; older versions of the Directive were referenced in some of the instruction manuals.

The traceability of numerical data was assessed against the standards and directives referenced in the instruction manuals. The credibility of the declared emission values in relation to stated operating conditions and likely risk in real use was assessed. The assessment was based on the noise data measured during visits to sites at which the machines were installed, as shown in Table 1. Table 2 contains an assessment of the compliance of the noise emission information against the noise requirements of the Machinery Directive.

**Table 2: Compliance with the noise requirements of the Machinery Directive** [Note: “n/a” not available; “n/r” not required]

	Inserter	Folding machine	Digital sheeter	Sheet-fed litho press	Roto-gravure press A	Roto-gravure press B	Folding carton gluer	Folder gluer	Die cutter	Waste baler	Flexo label press	Envelope inserting machine	Web-fed offset litho press A	Web-fed offset litho press B	Web-fed offset litho press C
Provision of numerical data	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Uncertainty data, if required <sup>1</sup>	n/a	x	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Traceability to measurement method & operating conditions	x	✓	x <sup>2</sup>	✓	✓	✓	x	✓	✓	x	x	✓	✓	✓	x
Credibility with regard to operating conditions	x <sup>3</sup>	✓ <sup>4</sup>	x	✓	✓	✓	x <sup>3</sup>	✓	✓	x	x <sup>3</sup>	✓	✓	✓	x <sup>3</sup>
Credibility with regard to real use risks	✓	✓	x	✓	✓	✓	✓	x	✓	x	✓	✓	✓	x	✓ <sup>5</sup>
Provision of information on protective measures <sup>6</sup>	✓	✓	x <sup>7</sup>	x	✓	✓	x <sup>7</sup>	x	x	x <sup>7</sup>	✓	x	x <sup>7</sup>	x <sup>7</sup>	✓
Provision of information on residual risk <sup>8</sup>	n/r	n/r	x	n/r	n/r	n/r	n/r	x	n/r	x	n/r	n/r	n/r	x	n/r

## NOTES:

- <sup>1</sup> The majority of instructions assessed were incomplete and there was no reference to the Machinery Directive 2006/42/EC (the first version of the Directive explicitly requiring uncertainty data) in the available pages; these are indicated by “n/a” (not available).
- <sup>2</sup> Operating conditions specified but no details of measurement method.
- <sup>3</sup> No operating conditions specified.
- <sup>4</sup> The terminology for the declared emission value is incorrect (A(I) and “<”); however the level is credible when compared with real use noise levels for this machine.
- <sup>5</sup> The terminology for the declared emission value is incorrect (sound intensity and “>”); however the range of measured real use noise levels is consistent with the noise level quoted.
- <sup>6</sup> This includes information on hearing protection and/or noise control measures, for example acoustic enclosures or covers.
- <sup>7</sup> Advice is provided on hearing protection, but it is either incorrect or not machine-specific. For example: “*at values  $\leq 80$  dB(A), hearing protection is recommended*” and “*hearing protection is advised depending on the total noise level of the machine and its environment*”.
- <sup>8</sup> For many machines the declared noise emission values were credible indicators of real use risk and therefore residual risk information was not required; these are indicated by “n/r” (not required). Note: Residual risk as defined here represents the gap between the risk associated with the declared noise emission value and the actual risk during real use.

## 6 DISCUSSION

### 6.1 PROVISION OF NUMERICAL DATA

The noise emission information in extracts from fifteen instruction manuals was assessed against the requirements of the Machinery Directive. All of the manuals contained emission sound pressure levels, none provided sound power levels. However, some printing machinery is very large. In the case of very large machinery, the Machinery Directive and harmonised standards for printing machinery allow for declared emission sound pressure levels at specified measurement points instead of sound power levels. Some of the machines observed in this study had a largest linear dimension below the criterion value of 15 m defined in EN 13023.

The terminology used to describe the declared noise emission values was varied. In eleven of the instruction manuals, it was clear what noise value was being presented, for example “*continuous equivalent level*”, “*acoustic pressure level*”, and “*sound pressure level*”. Some descriptors were ambiguous, for example “*noise level*” and two of the terms used to describe the noise data were incorrect. One declaration described “*noise pressure level (AI)*”. The use of *A(I)* suggests the measurement of an A-weighted peak sound pressure level using the Impulse time constant, which is inappropriate for machinery noise. One of the declarations was a “*sound intensity level*”. The emission values required are either sound pressure levels or sound power levels and, as such, it is more than likely that in these cases the terminology and/or the measured value are incorrect.

The Machinery Directive 2006/42/EC requires that the uncertainties associated with emission values are specified; earlier versions (89/393/EEC and 98/37/EC) did not explicitly require this information. Eleven of the fifteen instruction manual extracts assessed did not include a reference to any version of the Machinery Directive. However, it is possible that a reference was included in a part of the instructions not assessed. The four remaining instruction manuals contained a reference to the Machinery Directive; one to the current 2006/42/EC and three to earlier versions. None of the manuals included uncertainty data despite some referencing the noise test code EN 13023.

The noise test code for printing machinery, EN 13023, requires a dual-number noise declaration in accordance with EN ISO 4871. If machine-specific values for the uncertainty  $K$  are unavailable, values shall be taken from EN ISO 4871. For engineering grade accuracy (grade 2) measurements  $K_{pA} = K_{WA} = 2.5$  dB; for survey grade accuracy (grade 3) measurements  $K_{pA} = K_{WA} = 4$  dB. It is not clear why uncertainty data were not provided for any of the noise emission values assessed.

### 6.2 TRACEABILITY TO MEASUREMENT METHOD AND OPERATING CONDITIONS

The harmonised safety standards for printing machinery EN 1010 and EN 1034 both require noise measurements in accordance with the noise test code EN 13023. The noise test code provides details on what parameters should be measured, the measurement methods that should be used, and operating conditions for a wide range of printing machinery.

Appropriate safety standards or noise test codes were referenced in seven instruction manuals. Two instruction manuals contained details of the measurements made and operating conditions during the noise tests, but no standards were referenced. There was no information in five of the fifteen manuals on either the measurement method or operating conditions. The EC Declaration of Conformity was among the extracts provided for three of the fifteen manuals. However, two

of these declarations did not reference the appropriate harmonised safety standards as required; therefore there was no information on either the measurement method or operating conditions. The dates obtained from the instruction manuals were between March 1995 and March 2011. It is possible therefore that some of the printing machinery assessed predated the harmonised safety standard and noise test code. It should be noted, however, that earlier versions of the Machinery Directive required traceability to an appropriate measurement method and operating conditions.

### 6.3 CREDIBILITY OF NOISE EMISSION DATA

The noise test code for printing machinery defines operating conditions. These are intended to represent normal running of the machine, taking into account variable operating conditions, work cycles and varying applications. The declared noise emission data should therefore be comparable with the level of noise generated by the machine during normal use, and should be a credible indicator of real use noise risk. However, noise emission levels for many machines are made with the machines running at 80% of their rated speed. It is probable that the noise levels will be higher for faster machine speeds.

The noise emission data in seven instruction manuals were credible with regard to the specified operating conditions, and when compared with the real use noise levels for the same machinery installed in working premises.

The instruction manuals for six of the fifteen machines contained no information on measurement method or operating conditions. Therefore the credibility of the operating conditions used could not be assessed. However, the declared noise emission values in four of these manuals were comparable with the real use levels shown in Table 1. This suggests that a test method with appropriate operating conditions was used to obtain these declarations.

The declarations in five of the manuals stated that noise emission values were greater than or less than a specified level, for example “< 87 dB(A)”, “< 80 dB(A)”, “over 85 dB(A)” as shown in Table 1. This is not the correct format for a noise declaration, and it is unclear what guidance these machinery manufacturers were following. While some of the declarations were credible, others were not, and all failed to provide sufficient detail to help the user assess and manage real use risk. Examples taken from Table 1 include:

- Credible: Declared level < 87 dB(A), real use levels 80 – 83 dB(A)
- Not credible: Declared level < 80 dB(A), real use level 84 dB(A)
- Insufficient detail: Declared level > 85 dB(A), real use levels 73 – 100 dB(A)

Operating conditions were provided with the noise declaration for the digital sheeter, but there was no information on the measurement method. The declared noise emission value was approximately 10 dB lower than the level of noise generated by this machine in-situ. However, the condition of the digital sheeter for which noise measurements were made was observed to be poor, with missing and broken panels. The declaration is obtained using new machinery, and will therefore relate to well-maintained equipment in good condition.

The declared noise emission data provided in eleven of the fifteen instruction manuals assessed in this study were credible as indicators of real use risk. This suggests that the machine manufacturers are providing noise emission data that are representative of the noise generated during typical use of the machine. It also suggests that the data could be used by purchasers to adequately manage the noise risk associated with the printing machinery.

## 6.4 VALIDATION OF EMISSION DATA

The real use noise levels in ten of the instruction manuals were comparable with the emission  $L_{pA}$  values included in EN 1010-1 Annex E, ie there was some overlap between the two sets of data. This highlights another useful source of information for both manufacturers and purchasers. Manufacturers can assess the noise generated by their machine with that from comparable machines using data in Annex E to decide whether it has been designed to be among the quietest machines of its type, or state-of-the-art in terms of noise reduction. Purchasers who buy the standard could use the data in Annex E when buying new machines or in a noise risk assessment, in the absence of other noise data.

## 6.5 PROVISION OF INFORMATION ON PROTECTIVE MEASURES

### 6.5.1 Hearing protection

The harmonised safety standards for printing machinery (EN 1010 and EN 1034 series) require instruction manuals to include information on personal protective equipment, if appropriate.

Nine of the instruction manuals assessed gave information on hearing protection. The quality of this information varied from exemplary to poor, as shown in the following examples:

- Exemplary (ignoring the translation issues): *“Access near the folder, or, more generally, inside the press’ soundproof shielding structure, requires to wear noise-dampening-headphones. Considering the acoustic pressure levels which can be reached in the most unfavourable conditions, it’s advisable to use a device to allow a medium-high damping effect in heavy conditions (for instance, SNR = 27 dB).”*
- Poor (not machine-specific): *“Hearing protection is advised depending on the total noise level of the machine and its environment.”*

Machine-specific advice on using hearing protection was only found in three of these nine manuals. Six of these manuals contained general advice, recommending the use of hearing protectors when noise levels were high. These instructions provided no guidance on when high noise levels were probable, other than to say that they might occur due to machine location and other noise sources in the workplace.

The instructions for the digital sheeter provided the following general information on hearing protection: *“at values  $\leq 80$  dB(A), hearing protection is recommended, at values  $\geq 85$  dB(A) hearing protection must be worn”*. This guidance is incorrect (possibly a typographical error) as hearing protection is not recommended below 80 dB(A). Use of hearing protectors in low noise levels is likely to hinder essential communication (for example, safety instructions and audible warning alarms) and isolate individuals from their surroundings and colleagues. It is also unclear why guidance is provided when the declared noise emission for the sheeter is below 80 dB(A).

Six of the machines included in this assessment, whose instructions advised the use of hearing protection, were installed within designated hearing protection zones. The zones included printing areas, finishing areas, and inside acoustic enclosures. At many of the printing sites visited during this project, hearing protectors were available from dispensers. Operators were observed using hearing protection (earmuffs and earplugs) with varying degrees of competence.

### 6.5.2 Noise control measures

The safety standards for printing machinery identify methods for reducing noise. Five instruction manuals included information about noise control measures, for example sound-damping cover and noise enclosures. Emission data were also provided in the instructions to show the effectiveness of noise enclosures and of locating noisy components either in the print room or in a separate room.

One of the five instruction manuals with noise control information included the following guidance: “*the sound intensity level is over 85 dB(A) so that the user has to provide secondary sound insulation*”. While raising awareness of a noise issue, the information does not help the user decide what level of protection is needed and what control measures will be most effective for this printing press.

There is evidence that noise control measures are being applied within the printing industry to manage the risk from noise. Noise enclosures were observed at some of the printing premises visited during this project. While noise enclosures can be very effective at controlling workplace noise, they need to be installed properly, regularly maintained and used effectively. The following problems were observed: noise enclosure installed without a roof, poorly fitted doors, and doors permanently propped open.

## 7 PROVISION OF INFORMATION ON RESIDUAL RISK

Residual risk information is required when there is a gap between the risk associated with the declared noise emission values and the actual risk during real use. For eleven of the machines assessed, the declared noise emission values were comparable with real use noise levels. Therefore no additional information was required to help the user identify risk from noise.

The noise emission values contained in four of the instruction manuals did not represent real use noise levels; real use levels were higher by between 4 and 15 dB. It is not clear if the standard has been mis-applied or if the specified tests under-represent workplace noise for the observed application of these machines, for example operating at a faster speed than the standard test.

Where the standard test is known to under-represent real use noise, information is required to inform the user of the gap between the risk associated with the declared noise emission values and the actual risk during real use. The user needs to be aware of such discrepancies so that they implement adequate noise control measures. Although additional information was provided in some of the instructions, it was limited to general guidance, for example:

- *“The operator must carry out a workplace-related noise measurement on the installation location of the digital sheeter.”*
- *“They (noise measurements) were carried out in a free sound field environment, without sound reflection. In the case of reflections on nearby walls and/or the ceiling, the equivalent continuous sound A-weighted level is higher than that measured in a free sound field.”*
- *“The increase in the equivalent continuous sound A-weighted level due to the passage of blanks can vary considerably depending on the following criteria: board characteristics, type of blank, size of blank, machine settings.”*
- *“The machine generates a sound pressure level which may exceed 85 db(A) depending on its location.”*
- *“The calculation of the average noise-exposure level, needed to comply with the limits to noise-exposure provided for by the regulations about work hygiene, must be executed into the actual printing environment, considering all of the machines and equipment which run simultaneously and the operators’ stay time in the working areas.”*

The information provided in these examples does not provide the user with sufficient detail on the level of risk that needs to be controlled, other than it is highly likely that real use noise levels will be higher than the declared values.

The limitations of the declared noise emission values should be stated more clearly in the instructions so that the user knows additional work is needed to assess the risk from noise during typical use. In a good example, one set of instructions reported noise levels at workstations and consoles, including those locations that need to be attended within noise enclosures. This information would enable a reliable estimate of noise exposure and identification of appropriate noise controls.

## 8 CONCLUSIONS

- Harmonised safety standards (EN 1010 series, EN 1034 series) and a noise test code (EN 13023) are provided for printing machinery. Compliance with the normative clauses of these standards, within the limits of the standards, enables manufacturers to demonstrate conformity with the EHSRs of the Machinery Directive.
- The noise-related content of extracts taken from fifteen instruction manuals supplied with printing machinery was assessed against the noise clauses of the Machinery Directive. All the machines are currently used in the UK printing industry.
- The declared noise emission data provided in eleven of the fifteen (approximately 75%) instruction manuals were traceable and credible with regard to the operating conditions specified in the harmonised standards or noise test code.
- The declared noise emission data provided in eleven of the fifteen (approximately 75%) instruction manuals were generally considered to be a reliable indicator of real use risk. The operating conditions specified in the noise test code for printing machinery represent normal use and consequently the declared noise emission values were generally comparable with real use measurements on the same machines.
- None of the noise declarations provided uncertainty data, which are required by Machinery Directive 2006/42/EC and EN 13023.
- Information on protective measures was included in eleven of the fifteen (approximately 75%) instruction manuals, as required by the harmonised standards for printing machinery. This generally included information on using hearing protection, acoustic enclosures and sound covers. However, five of these manuals contained information that was either not machine-specific or incorrect. The use of acoustic enclosures and sound covers was observed in the printing industry.
- The declared noise emission values and real use noise levels for eleven of the fifteen (approximately 75%) machines assessed were comparable; therefore residual risk information was not required. However, machine-specific information to help assess and manage real use risk was not provided for the four machines whose emission data did not reflect real use risk.
- Assessing a sample of instruction manuals for machinery, currently used in the printing industry, showed that the majority contained declared noise emission information that would help the user assess and manage real use risk.

## 9 REFERENCES

Directive 2000/14/EC of the European Parliament and of the Council of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors

Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)

Directive 89/393/EEC of 14 June 1989 on the approximation of the laws of the Member States relating to machinery

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

EN 1010-1:2004+A1:2010 Safety of machinery - Safety requirements for the design and construction of printing and paper converting machines - Part 1: Common requirements

EN 1034-1:2000+A1:2010 Safety of machinery - Safety requirements for the design and construction of paper-making and finishing machines - Part 1: Common requirements

EN 13023:2003+A1:2010 Noise measurement methods for printing, paper converting, paper making machines and auxiliary equipment - Accuracy grades 2 and 3

EN ISO 11688-1:1998 Acoustics - Recommended practice for the design of low-noise machinery and equipment

EN ISO 11689:1996 Acoustics - Procedure for the comparison of noise emission-data for machinery and equipment

EN ISO 4871:2009 Acoustics - Declaration and verification of noise emission values of machinery and equipment

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# Noise risk as described in instructions supplied with printing machinery

The printing industry uses a wide range of noisy machines that have the potential to damage workers' hearing if the risks are not effectively managed. Users need information that represents noise emissions during the intended uses of the machine, to enable an assessment and the management of the associated noise risks.

There is a legal requirement under the Supply of Machinery (Safety) Regulations 2008 for machinery manufacturers to provide declared noise emissions in instruction manuals. (This legislation implements the EU Machinery Directive 2006/42/EC). However, there is a lack of information on the adequacy of declared noise emissions for printing machinery sold in the United Kingdom.

This report describes research that was carried out to assess the adequacy of the noise emission information provided in a sample of fifteen instruction manuals supplied by manufacturers of printing machinery. The study found that the noise content in the majority (approximately 75%) of the instructions gave declared noise emission information that would help the user assess and manage real use noise risks. However for 25% of the instructions, the noise emission information was either incorrect or not machine-specific. Additionally, none of the instructions provided information on the uncertainty associated with the measured noise emission values; this is legally required.

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