BS EN 14462:2015

BSI Standards Publication

Surface treatment equipment — Noise test code for surface treatment equipment including its ancillary handling equipment — Accuracy grades 2 and 3

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National foreword

This British Standard is the UK implementation of EN 14462:2015. It supersedes BS EN 14462:2005+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/3/8, Thermoprocessing equipment - Safety.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Surface treatment equipment - Noise test code for surface treatment equipment including its ancillary handling equipment - Accuracy grades 2 and 3

Equipements de traitement de surface - Code d'essai acoustique pour équipements de traitement de surface, y compris les équipements de manutention auxilliaires - Classes de précision 2 et 3

Oberflächenbehandlungsgeräte - Geräuschmessverfahren für Oberflächenbehandlungsgeräte - einschließlich ihrer Be- und Entladeeinrichtungen - Genauigkeitsklassen 2 und 3

This European Standard was approved by CEN on 29 November 2014.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 14462:2015) has been prepared by Technical Committee CEN/TC 271 “Surface treatment equipment - Safety”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2015 and conflicting national standards shall be withdrawn at the latest by August 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14462:2005+A1:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive 2006/42/EC, see informative Annex ZA, which is an integral part of this document.

This document includes the following significant technical changes with respect to EN 14462:2005+A1:2009:

— integration of dry ice blasting equipment in A.1.2;

— integration of automatic electrostatic application equipment for flammable flock material (EN 50223) in A.3.1.

It augments the “C”-type safety standards prepared by CEN/TC 271. Its purpose is to provide a means of determination, declaration and verification of noise emission for the equipment within the scope of this document. The determination of noise emission values is a prerequisite for a manufacturer to assess the noise reduction obtained at the design stage.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This noise test code gives assistance to carry out noise emission measurements and to determine values for noise declaration purposes under the Machinery Directive 2006/42/EC and provides the means for their verification. Annex D with Figure D.1 and Figure D.2 provides an overview on the noise determination procedure.

Noise emission characteristics include both emission sound pressure levels at workstations and sound power levels. The determination of these characteristics is necessary for

— manufacturers to declare the noise emitted,

— comparing the noise emitted by machines,

— purposes of noise control at the source during the design stage,

— estimation of noise exposure at the workstation(s).

Noise testing of the machinery can be done at the manufacturer's site, at the place of mounting or at any other adequate location.

1 Scope

This European Standard specifies standardized conditions for the determination, declaration and verification of airborne noise emission of the following surface treatment equipment:

— machinery for cleaning and pre-treatment of industrial item surfaces (see EN 12921-1, EN 12921-2, EN 12921-3, EN 12921-4);

— phosphating machinery;

— plating machinery;

— plasma surface treatment machinery;

— machinery for the supply and/or circulation of coating materials under pressure (see EN 12621, EN 12757-1);

— atomizing and spraying equipment for coating materials (see EN 1953, EN 50050-1, EN 50050-2, EN 50050-3, EN 50059, EN 50176, EN 50177, EN 50348);

— coating plants (see EN 12215, EN 12581, EN 12981, EN 13355, EN 50223);

— dryers, ovens and evaporating equipment (see EN 1539);

— thermal cleaning plants (incinerators) for exhaust gas from surface treatment plants (see EN 12753);

— dry-ice blasting equipment.

For the above surface treatment machinery, this European Standard gives provisions for the determination of

— emission sound pressure levels at workstations and/or other specified positions and

— sound power levels.

This European Standard specifies noise emission measurement methods, mounting and operating conditions that shall be used for the test. The use of this document ensures the reproducibility of the determination of the noise emission characteristics within specified limits determined by the grade of accuracy of the basic noise emission measurement method used (see Clause 4 and Clause 5). Noise emission measurement methods allowed by this document are engineering methods (grade 2) and survey methods (grade 3).

This European Standard does not apply to machines not explicitly listed in the scope:

— printing, paper converting and paper making machinery and auxiliary equipment (see EN 13023);

— abrasive blasting machinery see EN 1265.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1539, *Dryers and ovens, in which flammable substances are released — Safety requirements*

EN 1953, *Atomising and spraying equipment for coating materials — Safety requirements*

EN 12215, *Coating plants — Spray booths for application of organic liquid coating materials — Safety requirements*

EN 12581, *Coating plants — Machinery for dip coating and electrodeposition of organic liquid coating materials — Safety requirements*

EN 12621, *Machinery for the supply and circulation of coating materials under pressure — Safety requirements*

EN 12753, *Thermal cleaning systems for exhaust gas from surface treatment equipment — Safety requirements*

EN 12757-1, *Mixing machinery for coating materials — Safety requirements — Part 1: Mixing machinery for use in vehicle refinishing*

EN 12921-1, *Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours — Part 1: Common safety requirements*

EN 12921-2, *Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours — Part 2: Safety of machines using water based cleaning liquids*

EN 12921-3, *Machines for surface cleaning and pre-treatment of industrial items using liquids or vapours — Part 3: Safety of machines using flammable cleaning liquids*

EN 12921-4, *Machines for surface cleaning and pretreatment of industrial items using liquids and vapours — Part 4: Safety of machines using halogenated solvents*

EN 12981, *Coating plants — Spray booths for application of organic powder coating material — Safety requirements*

EN 13355, *Coating plants — Combined booths — Safety requirements*

EN 50223, *Stationary electrostatic application equipment for ignitable flock material — Safety requirements*

EN ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

EN ISO 3746, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746)*

EN ISO 3747, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering/survey methods for use in situ in a reverberant environment (ISO 3747)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 9614-2, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning (ISO 9614-2)*

EN ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11202, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections (ISO 11202)*

EN ISO 11204, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections (ISO 11204)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
emission sound pressure
p
sound pressure, at a specified position near a noise source, when the source is in operation under specified operating and mounting conditions on a reflecting plane surface excluding the effects of background noise as well as the effects of reflections other than those from the plane or planes permitted for the purpose of the test

Note 1 to entry: Emission sound pressure is expressed in pascals.

[SOURCE: EN ISO 11201:2010, 3.2, modified]

3.2
emission sound pressure level
***L*$_p$**
ten times the logarithm to the base 10 of the ratio of the square of the emission sound pressure, $p^2(t)$, to the square of the reference sound pressure, p_0^2 (the reference sound pressure is 20 µPa), measured with a particular time weighting and a particular frequency weighting, selected from those defined in EN 61672-1

Note 1 to entry: Emission sound pressure level is expressed in decibels.

Note 2 to entry: The emission sound pressure level of surface treatment equipment is determined at specified positions in accordance with this document.

[SOURCE: EN ISO 11201:2010, 3.3, modified]

3.3
average emission sound pressure level
$\overline{L}_p$
energy-average of the emission sound pressure levels L_p at several microphone positions around the machine

3.4
sound power
W
rate per unit time at which airborne sound energy is radiated by a source

Note 1 to entry: Sound power is expressed in watts.

[SOURCE: EN ISO 3744:2010, 3.20, modified]

3.5
sound power level
***L*$_W$**
ten times the logarithm to the base 10 of the ratio of the sound power radiated by the source under test to the reference sound power, which is 1 pW (10^{-12} W)

Note 1 to entry: Sound power level is expressed in decibels.

Note 2 to entry: The frequency weighting or the width of the frequency band used is indicated, for example, A-weighted sound power level (L_{WA}).

[SOURCE: EN ISO 3744:2010, 3.21, modified]

3.6
work station
operator's position
position in the vicinity of the machine under test which is intended for an operator

Note 1 to entry: The work station represents the occasional or permanent intervention position designed for operators and situated inside or in the vicinity of the machine under test.

[SOURCE: EN ISO 11201:2010, 3.11, modified]

3.7
specified position
position defined in relation to a machine including, but not limited to, an operator's position

Note 1 to entry: The position can be a single fixed point, or a combination of points along a path or on a surface located at a specified distance from the machine.

[SOURCE: EN ISO 11201:2010, 3.13, modified]

3.8
reference box
hypothetical surface which is the smallest rectangular parallelepiped that just encloses the source and terminates on the reflecting plane or planes

[SOURCE: EN ISO 3744:2010, 3.10, modified]

3.9
measurement surface
hypothetical surface of area *S*, enveloping the source, on which the measurement positions are located and terminating on one or more reflecting planes

[SOURCE: EN ISO 3744:2010, 3.14, modified]

3.10
very large machine
machine with dimensions of 7 m in length or more or 4 m in height or more

Note 1 to entry: Machines extending over several floors are regarded as very large machines, in every case.

3.11
work cycle
operation of a machine producing a periodic fluctuation of noise emission or a series of working processes with different noise emissions that repeats itself

Note 1 to entry: One characteristic work cycle can be defined as the operating conditions for the machine under test.

4 Determination of A-weighted emission sound pressure level at workstations and other specified positions

4.1 General

A-weighted emission sound pressure levels L_{pA} shall be determined according to one of the following basic standards:

— EN ISO 11201 (grade 2) for machinery which can be tested in an essentially free field over a reflecting plane (e.g. outdoor test location or adequate test room);

— EN ISO 11202 (grade 2 or grade 3) or EN ISO 11204 (grade 2 or grade 3), for machinery which cannot be tested in an essentially free field over a reflecting plane:

  — where ever possible, grade 2 methods shall be used;

  — if grade 3 methods are used, a justification shall be recorded and reported.

NOTE For the purpose of reducing noise at source at the design stage, it is useful to determine emission sound pressure levels at workstations in frequency bands. These levels can be obtained using these basic standards.

4.2 Measurement positions

If workstations are defined, the A-weighted emission sound pressure shall be determined at the workstations.

Annex A specifies the measurement positions for particular surface treatment machines.

If no workstation is defined, or Annex A does not specify measurement positions, the measurement positions shall be located on a path at 1,6 m above the floor and 1 m from the external surface of the machine. The location of these points and the sound pressure levels measured shall be indicated in the test report and in the noise declaration. The maximum distance between two consecutive points shall be 2 m. In this case, the highest value measured shall be taken as the A-weighted emission sound pressure level for the machine.

The following additional requirements apply:

— if the application of the provisions leads to measurement positions that are not practical and/or dangerous, closest positions that are practical and/or not dangerous shall be chosen. For a machine comprising several floors, individual measurement positions shall be defined on each floor;

— for machines placed at a distance of less than 2 m from a boundary surface, there shall be no measurement positions on the side facing the boundary;

— for installations consisting of several machines, individual measurement positions shall be defined

  — for any individual machine of the installation, if the distance to all neighbouring machines exceeds 2 m;

  — for parts of the installation, for which the distances between neighbouring machines do not exceed 2 m;

  — for the complete installation, if all distances between neighbouring machines do not exceed 2 m.

Installations consisting of several machines shall always be considered as very large machines (see 5.2).

See Annex C, Figure C.1 and Figure C.2, for examples of the arrangement of measurement positions.

5 Determination of A-weighted sound power level

5.1 General

A-weighted sound power levels L_{WA} shall be determined according to one of the following basic standards:

— EN ISO 3744 (grade 2);

— EN ISO 3746 (grade 3);

— EN ISO 3747 (grade 2 and grade 3);

— EN ISO 9614-2 (grades 2 and grade 3).

Where ever possible, grade 2 methods shall be used. If grade 3 methods are used, a justification shall be recorded and reported.

When EN ISO 3744 or EN ISO 3746 is used the measurement surface shall be the parallelepiped one.

NOTE EN ISO 3744 (grade 2) or EN ISO 3746 (grade 3) are appropriate methods for many applications when machines can be measured outdoors or indoors in an adequate environment. In an approximately reverberant field EN ISO 3747 allows the determination of sound power levels with grade 2 by using a reference sound source (comparison method). In cases of extremely bad environmental conditions (reverberant field and/or high levels of extraneous noise) intensity methods according to EN ISO 9614-2 (scanning method) can be the only applicable method.

5.2 Measurement positions for very large machines

For machines longer than 7 m, instead of the A-weighted sound power level, A-weighted emission sound pressure levels shall be determined at points located around the machine.

NOTE Compared to the determination of sound power levels this procedure requires less time and effort.

The measurement positions shall be located on a path at 1,6 m above the floor and 1 m from the external surface of the machine. The maximum distance between two consecutive points shall be 2 m.

For machines longer than 6 m, in areas far from dominant sound sources the maximum distance between two consecutive points may be 2 m.

The energy-average $\overline{L}_{\mathrm{pA}}$ of the emission sound pressure levels $L_{p\mathrm{A}}$ at all measurement positions, shall be the characteristic value for the description of noise emission.

The location of these points and the sound pressure levels measured shall be indicated in the test report and in the noise declaration.

6 Measurement uncertainties

The total measurement uncertainty of the noise emission values determined according to this European Standard is depending on the standard deviation of reproducibility of the measurement $\sigma_{R_0}^2$ given by the applied noise emission measurement method and the uncertainty associated with the instability of the operating and mounting conditions for the machine σ_{omc}^2. The resulting total standard deviation σ_{tot} is then calculated as:

$$\sigma_{tot}^2 = \sigma_{R_0}^2 + \sigma_{omc}^2$$

The upper bound value of σ_{R_0} is about 1,5 dB for the grade 2 measurement methods dealing with the determination of the emission sound pressure level or the sound power level.

NOTE 1 For more information on measurement uncertainty, see EN ISO 11201:2010, Clause 11 and Annex C, or EN ISO 3744:2010, Clause 9 and Annex H.

NOTE 2 For machines with a rather constant noise emission, a value of 0,5 dB for σ_{omc} can apply. In other cases, e.g. a large influence of the material flow into and out of the machine or material flow that varies in an unpredictable manner, it is possible that a value of 2 dB may be more appropriate. Methods to determine σ_{omc} are described in the basic measurement standards.

The expanded measurement uncertainty *U*, in decibels, shall be calculated with k = 2, the coverage factor, for two-sided normal distribution at confidence level of 95 %, from

$$U = k \cdot \sigma_{tot}$$

NOTE 3 The expanded measurement uncertainty depends on the desired confidence level. For the purpose of comparing the result with a limit value, it is appropriate to apply the coverage factor for a one-sided normal distribution. In that case, the coverage factor *k* = 1,6 corresponds to a 95 % confidence level. Further information is given in EN ISO 4871. Note that the expanded measurement uncertainty U is denoted K in EN ISO 4871.

NOTE 4 The expanded measurement uncertainty as described in this European Standard does not include the standard deviation of production which is used in EN ISO 4871 for the purpose of making a noise declaration for batches of machines.

7 Mounting conditions

Machines shall be mounted in accordance with the manufacturer's instructions.

Mounting instructions for applicators are given in Annex A.

If no manufacturer's mounting instructions are given, mounting conditions used shall be recorded and reported.

NOTE In general, complex machines for surface treatment consisting of different components will only be mounted at the place of operation; thus, the mountings conditions are given.

The mounting conditions shall be identical for the determination of both sound power level and emission sound pressure levels at specified positions, and for declaration purposes.

8 Operating conditions

The test shall be carried out with

— all sources of noise which are normally present when the machine is under operation (e.g. pump, fan, conveyor),

— all noise reduction measures which are part of the machine.

Annex A defines the operating conditions for specific machinery.

If operating conditions defined in Annex A cannot be used, the reason shall be given and the conditions used shall be recorded, reported and declared.

Measurement shall cover the normal work cycle.

The work cycle used for the test shall be described precisely in the test report.

For multi-purpose machines, the operating condition with the highest noise emission shall be chosen.

Idling periods that are not compulsory for the operation condition chosen shall not be included into the test.

Operating conditions shall be identical for determination and declaration of A-weighted sound power level and A-weighted emission sound pressure level.

NOTE Noise emission depends on the operation mode of the machine. The specification of operating conditions allows noise emission data to be compared.

9 Information to be recorded

The information to be recorded during the test shall include all the information required by the relevant basic noise emission standards used for the machine under test:

— acoustic environment,

— instrumentation,

— acoustic data.

Any deviation(s) from this noise test code or from the basic standard(s) used, shall be recorded together with the technical justification for such deviation(s).

10 Information to be reported

The information to be provided in the test report shall at least include the information necessary for declaration and verification of noise emission values. The required information is given in the basic standards used, i.e.:

a) machine

   1) type,

   2) classification and technical data,

   3) dimensions,

   4) manufacturer,

   5) serial number and year of manufacture,

b) mounting and operating conditions relevant to noise emission during the test (see Clause 4 and Clause 5 and Annex A),

c) basic standard(s) applied for the determination of noise emission (see Clause 4 and Clause 5), giving, where applicable, reasons for not using grade 2 methods,

d) acoustic data

1) A-weighted emission sound pressure level at workstations (L_{pA}),

2) if required, A-weighted sound power level (L_{WA}) or average A-weighted emission sound pressure level ($\overline{L}_{pA}$),

NOTE Individual A-weighted emission sound pressure levels measured on large machines can be supplied as additional information.

e) Organisational test data

1) place;

2) date;

3) responsible person.

Any deviation(s) from this noise test code or from the basic standard(s) used, are to be recorded together with the technical justification for the deviation(s).

11 Declaration and verification of noise emission values

The noise declaration shall be made as dual-number noise emission value(s) according to EN ISO 4871.

The following values shall be declared in the instructions for use, and in the technical sales literature if any.

— A-weighted emission sound pressure level at workstations, where this exceeds 70 dB (A); where this level does not exceed 70 dB (A), this fact shall be indicated.

— If there is no work station the highest value of the A-weighted emission sound pressure level on a measurement path (see 4.2) and the position of the corresponding measurement position.

— A-weighted sound power level emitted by the machinery where the A-weighted emission sound pressure level at least one workstation or specified measurement position exceeds 80 dB (A).

— In the case of very large machines, instead of the sound power level, the A-weighted average emission sound pressure level.

The noise declaration shall give a detailed description of the work cycle.

The uncertainty *U* associated to each declared value shall be declared (see Clause 6).

For a production series of machines the arithmetic average of the A-weighted measured noise emission values and the uncertainty *U* shall be declared (see EN ISO 4871:2009, Annex A).

The noise declaration shall mention explicitly that the noise emission values have been obtained according to this noise test code, and indicate which basic noise measurement standard(s) have been used. If this is not applicable, deviations from the basic noise measurement standard(s) shall be indicated precisely.

The method used and the grade of accuracy applied shall be stated. The noise test code designation shall contain the following information:

— the term “noise test code”;

— the reference to this standard, “EN 14462”, with its date of publication;

— the grade of accuracy applied (grade 2 or 3).

NOTE 1 EN ISO 4871:2009, Annex A, gives a procedure for drafting the noise declaration.

NOTE 2 Figure 1 gives an example of dual-number noise declaration.

Verification of the declared noise emission values can be carried out by means of measurements, using preferably the basic measurement standard used for the declaration or a measurement standard of a higher grade of accuracy. If agreed between manufacturer and user, the verification can also be carried out according to a measurement procedure of a lower grade of accuracy. The verification shall be conducted by using the same mounting and operating conditions as those used for the initial determination of noise emission values.

For verification, the procedure defined in EN ISO 4871:2009, 6.2, for individual machines shall be used. The declared value L is verified if the measured noise emission value L_1 is less than or equal to (L + K):

$$L_1 \leq L + K.$$

Machine XXX, Model Number XXXX, and other identifying information

Declared Dual-Number noise emission values according to EN ISO 4871

A-WEIGHTED EMISSION SOUND PRESSURE LEVEL AT THE WORKSTATION:

Measured value	L_{pA} = 86 dB (re 20 µPa)
Uncertainty	U_{pA} = 2,5 dB

A-WEIGHTED SOUND POWER LEVEL

Measured value	L_{WA} = 101 dB (re 1 pW)
Uncertainty	U_{WA} = 2,5 dB

Values determined according to noise test code EN 14462:2014, Annex A, A.x using the basic standards

[EN ISO 11204-grade 2 and EN ISO 3744]

And the following work cycle:

[description or diagram explaining the work cycle]

NOTE The sum of the measured noise emission value and its associated uncertainty represents an upper boundary of the range of values which is likely to occur in measurements.

Figure 1 — Example of dual-number noise declaration for a not very large machine with one workstation

Annex A
(normative)

Operating conditions and measurement positions for the determination of noise emission of surface treatment machinery

A.1 Pre-treatment, cleaning, degreasing and phosphatising machines (batch and continuously fed)	
A.1.1 Machines using liquid agents EN 12921–1, EN 12921–2, EN 12921–3, EN 12921–4	
Operating conditions	Requirements of Clause 8 shall be followed. Liquid pumps and fans shall be operated at rated power. Machine shall be loaded with maximum load. Work pieces used for the test shall be described precisely (i.e. surface material, dimension and shape) in the test report and the noise declaration.
Workstation or specified measurement position	No specific workstation, unless defined by the manufacturer (e.g. at control panel). See 4.2 for determination of other specified positions.
A.1.2 Machines using solid agents Dry ice blasting machinery	
Operating conditions	Requirements of Clause 8 shall be followed. The applicator shall be — installed on a non-noise-reflecting pole at a height of 1,6 m; — operated as recommended by the manufacturer with the most commonly recommended nozzle-size, and where applicable, the — maximum operating air pressure — maximum operating CO_2 pressure — maximum CO_2 throughput. The spray cone shall — be oriented horizontally; — not be reflected by surfaces. Requirements for ancillary equipment: — Air pressure supply system shall be separated from the dry ice blasting equipment by a distance such that its noise emission does not influence the sound pressure level measurement
Workstation or specified measurement position	Reverse to the spray-direction, at a distance of 1 m from the nozzle outlet and at a height of 1,6 m above the floor.

A.2 Coating and mixing machinery and supply systems for coating materials	
A.2.1 Atomising and spraying equipment EN 1953 NOTE Applicators in scope of EN 50050–1, EN 50050–2, EN 50050–3, EN 50059, EN 50176, EN 50177, EN 50223, EN 50348, are also in scope of EN 1953.	
Operating and mounting conditions	Requirements of Clause 8 shall be followed. Equipment shall be — installed on a non-noise-reflecting pole at a height of 1,6 m; — operated as recommended by the manufacturer with the most commonly recommended nozzle-size, air pressure and air cap destination which cause the highest noise emission. — operated with — water for applicators for liquid coating material; — air pressure only for applicators for powder coating material. The spray cone shall — be oriented horizontally; — not be reflected by surfaces. Requirements for ancillary equipment: — Air pressure supply system shall be separated from the atomising or spraying equipment by a distance such that its noise emission does not influence the sound pressure level measurement — Spray booth extraction fans shall not be operated.
Workstation or specified measurement position	On the backside and both sides 90° to the spray-direction, at a distance of 1 m from the nozzle outlet and at a height of 1,6 m above the floor.
A.2.2 Machinery for the supply and circulation for coating materials under pressure EN 12621	
Operating conditions	Requirements of Clause 8 shall be followed. Equipment shall be operated — with coating material described in intended use — as recommended by the manufacturer with the most commonly recommended pressure settings for coating materials and/or air pressure, oscillation speed and size of silencer, and — if operation with an application system significantly contributes to noise emission — by feeding the application system and — separation of the application system from the machinery to a distance such that its noise emission does not influence the sound pressure level measurement. Requirements for ancillary equipment: — spray booth extraction fans shall not be operated.

Workstation or specified measurement position	No workstation specified. See 4.2 for requirements.
A.2.3 Mixing machinery for coating materials EN 12757–1	
Operating conditions	Requirements of Clause 8 shall be followed. Equipment shall be operated as recommended by the manufacturer with maximum recommended performance of power source; all agitators in operation; test-medium: water or coating material.
Workstation or specified measurement position	On the front side and both sides left and right at a distance of 1 m and at a height of 1,6 m above the floor;
A.3 Coating plants	
A.3.1 spray booths EN 12215, EN 12981, EN 13355, EN 50223	
Operating conditions	Requirements of Clause 8 shall be followed. Equipment shall be operated with — fans and if applicable liquid pumps in operation at rated power — spraying systems not in operation.
Measurement position(s) at work stations and other specified positions	For manually operated spray booths work stations are specified. See Annex B for requirements. For automatically operated spray booths — No specific workstation, unless defined by the manufacturer (e.g. at control panel). — See 4.2 for determination of other specified positions.
A.3.2 Dip coating machine (dip tank, dip area) EN 12581	
Operating conditions	Requirements of Clause 8 shall be followed. Equipment shall be operated with recirculation pumps, fans for lip extraction or fans for fresh air and exhaust gases at rated power.
Workstation or specified measurement position	No specific workstation, unless defined by the manufacturer (e.g. at control panel). See 4.2 for determination of other specified positions.

A.4 Dryers and thermal cleaning systems	
A.4.1 Dryers EN 1539	
Operating conditions	Requirements of Clause 8 shall be followed. Equipment shall be operated with — Recirculation fans shall be operated at rated speed. — Heating systems shall be in operation. — Dampers for regulation of recirculating air and exhaust gases shall be adjusted. Additionally — Chamber dryers shall operate at maximum load with closed and/or open loading door, according to the intended use. — Continuous flow dryers shall be loaded by the conveyor at rated speed.
Workstation or specified measurement position	If applicable for manually loaded chamber dryers — In the middle of the loading area; at a distance of 0,5 m from the front edge and at a height of 1,6 m above the floor. All other dryers — No specific workstation, unless defined by the manufacturer (e.g. at control panel). — See 4.2 for determination of other specified positions.
A.4.2 Thermal cleaning systems for exhaust gases EN 12753	
Operating conditions	Requirements of Clause 8 shall be followed. Equipment shall be operated with fans and burners at rated power.
Workstation or specified measurement position	No specific workstation, unless defined by the manufacturer. See 4.2 for determination of other specified positions.

Annex B
(normative)

Work stations for manually operated open-fronted spray booths and enclosed spray booths

B.1 General

For spray booths with an operator's position inside the booth, A-weighted sound pressure levels shall be measured in a section of the horizontal plane at 1,6 m above the floor and at more than 1 m from the walls of the spray booth, if possible, as well as from any large noise reflecting surface:

— at the operators position(s) defined in the manufacturer's instructions, if any,

— or, at one or more points in the central zone of the spray booth as defined in B.2 and in B.3.

For open fronted spray booths with no operator's position inside the booth, measurements shall be carried out at the position defined in B.2.

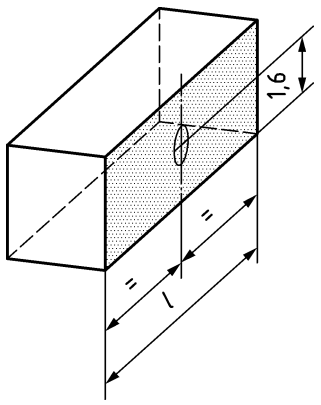
In all cases, measurements shall be carried out with the booth empty and with no operator present.

The position(s) where measurements have been carried out shall be indicated in the test report and in the noise declaration.

B.2 Open fronted spray booth

Measurements shall be carried out at one single point defined as follows:

A single measurement position in the opening plane of the spray booth along the vertical symmetrical axis of the spray booth at a height of (1,6 ± 0,03) m, see Figure B.1.



Key

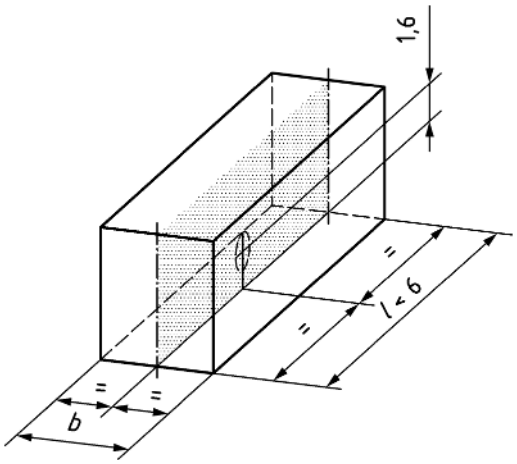
⊕ measurement position

Figure B.1 — Measurement position in an open fronted spray booth with the operator's position outside the booth

B.3 Open top and enclosed spray booth

For spray booths not exceeding 6 m length, measurements shall be carried out at one single point located at the centre of the spray booth, (1,6 m ± 0,03) m above the floor (see Figure B.2). For booths exceeding 6 m length (see Figure B.3) additional measurement position shall be located on each direction every 2 m from the central point. The highest measured value with measurement position shall be reported.

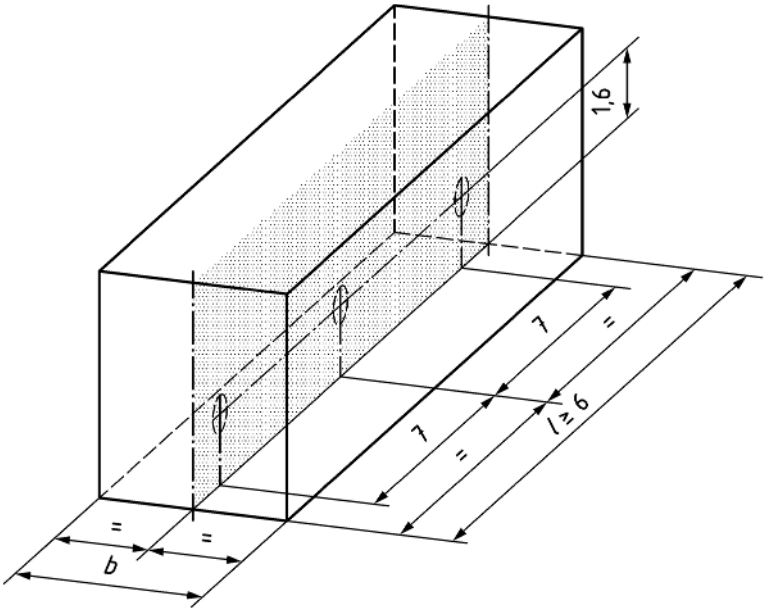
Additional measurements outside the booth according to 4.2 shall be taken.



Key

⊕ measurement position

Figure B.2 — Measurement position in open top and enclosed booth (not exceeding 6 m length)



Key

⊕ measurement position

Figure B.3 — Measurement positions in open top and enclosed booth (exceeding 6 m length)

Annex C
(informative)

Example for the determination of the A-weighted emission sound pressure level values for a machine without a defined work station

C.1 Object to be measured

Continuous flow dryer, in which flammable substances are released with recirculating air.

Technical data:

—	volume of recirculating air	2 × 13 000 m^3/h
—	temperature of recirculating air	140 °C
—	calorific power	
	(indirect heating by means of oil burner)	200 kW
—	dimensions	The reference box (see Figure C.1) including all noise-emitting components, such as fans and burners, has the following dimensions: l_1 = 2,5 m; l_2 = 14,7 m; l_3 = 4,6 m

C.2 Operating conditions

Recirculation fans are operated at rated power. Heating aggregates and burner are in operation. Dampers for regulation of recirculation air and exhaust gases were adjusted. Dryer is charged by the conveyor at rated speed (see A.4.1).

C.3 Mounting conditions

The continuous flow dryer is installed in a room with flat roof (dimensions 29 m x 20 m x 12 m, see Figure C.2). A pre-treatment machine is installed at a distance of 8,5 m.

The room is built with smooth hard walls made of concrete and a sound absorbing ceiling. The upper part of the walls is partially glazed.

C.4 Determination of emission sound pressure level

C.4.1 Measurement positions

Because there exist no identified or fixed work stations (no definition of work stations in Annex A) the measurement positions are chosen following the procedure described in 4.2. The resulting arrangement of measurement positions on the measuring path is shown in Figure C.1, where 2b = 16,7 m is subdivided in three sections of 5,57 m (≤7 m) and 2a = 4,5 m is one section. The measurement positions are located in the middle of each section. Figure C.2 shows the location of measurement positions in the ground plan of the room.

C.4.2 Environmental indicator K_2

The environmental indicator (correction) K_2 can be determined according to EN ISO 3744 with an estimated value of the mean sound absorption coefficient $\overline{\alpha}$ equal to 0,3. The equivalent sound absorption area A of the room can be calculated by Formula (C.1):

$$A = \overline{\alpha} \times S_V \tag{C.1}$$

where

$\overline{\alpha}$ is the mean sound absorption coefficient of the room;

S_V is the total area of the boundary surfaces of the room (walls, ceiling and floor);

A = 0,3 × 2 336 m^2 = 700,8 m^2.

With respect to the area S of the measurement surface including the chosen measurement positions of S = 312,6 m^2 the environmental indicator K_2 is calculated from:

$$K_2 = 10 \lg\left[1 + 4\,(S / A)\right]\ dB \tag{C.2}$$

$$K_2 = 4{,}5\,dB \tag{C.3}$$

Under these environmental conditions only a class 3 method (survey method) can be applied.

The measurement is performed according to EN ISO 11202.

C.4.3 Local environmental correction K_3

For the calculation of the local environmental correction k_3 according to EN ISO 11202 the distance "a" from every specified position to the closest major sound source of the machine shall be determined. In cases where the major sound source is not well-defined, the distance to the closest part of the machine shall be chosen as distance "a".

For the continuous flow dryer under test the distance "a" is estimated for all measurement positions to be 1,5 m, resulting in a corresponding measurement surface ($S = 2\ \pi\ \text{x}\ a^2$) of 14,1 m^2.

The local environmental correction K_3 is calculated by Formula (C.4):

$$K_3 = \lg\left[1 + 4\,(S / A)\right]\ dB \tag{C.4}$$

where

A = 700,8 m^2 (see C.4.2);

S = 14,1 m^2;

K_3 = 0,3 dB.

C.4.4 Acoustical data

The A-weighted sound pressure levels were determined at every defined measurement position/work station with the machine running under specified operating conditions (L'_{pA}) and with the machine turned off (background noise L''_{pA}). The results are listed in Table C.1.

Table C.1 — Measured sound pressure levels

measurement position no.	A-weighted sound pressure level	
	Machine noise L'_{pA} dB	Background noise L''_{pA} dB
1	83,2	< 60
2	79,6	< 60
3	81,3	< 60
4	81,2	< 60
5	83,2	< 60
6	80,0	< 60
7	79,8	< 60
8	81,2	< 60

Because the difference ΔL between the sound pressure levels measured with the machine in operation and turned off is more than 10 dB at every measurement position (ΔL > 10 dB), the correction for background noise K_1 according to EN ISO 11202 is zero:

K_1 = 0 dB

C.4.5 Calculation of emission sound pressure levels

The emission sound pressure levels L_{pA} at the specified positions are calculated by applying the background noise correction K_1 and the local environmental correction K_3 to the measured sound pressure level L'_{pA} of the machine:

$$L_{pA} = L'_{pA} - K_1 - K_3 \quad \text{(C.5)}$$

The corresponding results are listed in Table C.2.

Table C.2 — Measured sound pressure levels L'_{pA}, corrections K_1 and K_3 and emission sound pressure levels L_{pA}

measurement position no.	Measured sound pressure level L'_{pA} dB	Background noise correction K_1 dB	Local environmental correction K_3 dB	Emission sound pressure level L_{pA} dB
1	83,2	0	0,3	82,9
2	79,6	0	0,3	79,3
3	81,3	0	0,3	81,0
4	81,2	0	0,3	80,9
5	83,2	0	0,3	82,9
6	80,0	0	0,3	79,7
7	79,8	0	0,3	79,5
8	81,2	0	0,3	80,9

According to 4.2, the highest measured value and the position of the corresponding measurement position shall be reported.

The highest values L_{pA} of 83 dB were determined at the measurement positions 1 and 5 at the inlet and outlet of the machine at a distance of 1 m.

C.5 Determination of sound power level and average emission sound pressure level

Additional information on the sound power level of the machine is required where the A-weighted sound pressure level at workstations (emission sound pressure level) exceeds 80 dB (A). Because the calculated emission sound pressure levels of this machine are lower the determination of the sound power level is not necessary.

According to 3.10, the tested machine can be regarded as a very large machine (about 15 m in length) and thus the average emission sound pressure level $\overline{L}_{pA}$ is to be determined instead of the sound power level.

Although the determination of the average emission sound pressure level L_{pA} is not required for this specific machine (L_{pA} < 80 dB) the measurement procedure is described in few words:

According to 5.2, the arrangement of measurement positions and the determination of the individual emission sound pressure levels is the same as described in 4.2 for machines with no identified or fixed work stations. Therefore the corresponding measurements and calculations are identical to C.4.1 to C.4.5.

The average emission sound pressure level $\overline{L}_{pA}$ is calculated as the energy-average of all emission sound pressure levels L_{pA} listed in Table C.2:

$$\overline{L}_{pA} = 10 \lg \left[\frac{1}{N} \sum_{i=1}^{N} 10^{0,1 \cdot L_{pAi}} \right] \text{ dB} \qquad \text{(C.6)}$$

where

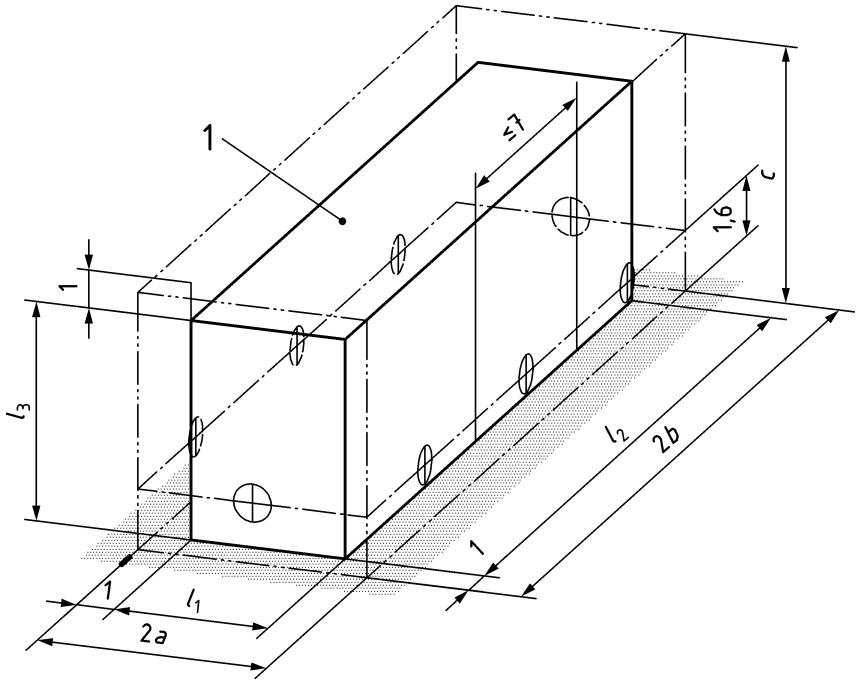
$\overline{L}_{pA}$ is the average emission sound pressure level;

L_{pAi} is the emission sound pressure level at the measurement position i;

N is the number of measurement positions.

The average emission sound pressure level $\overline{L}_{pA}$ of the tested recirculation air dryer is 81,0 dB.

Dimensions in metres



Key

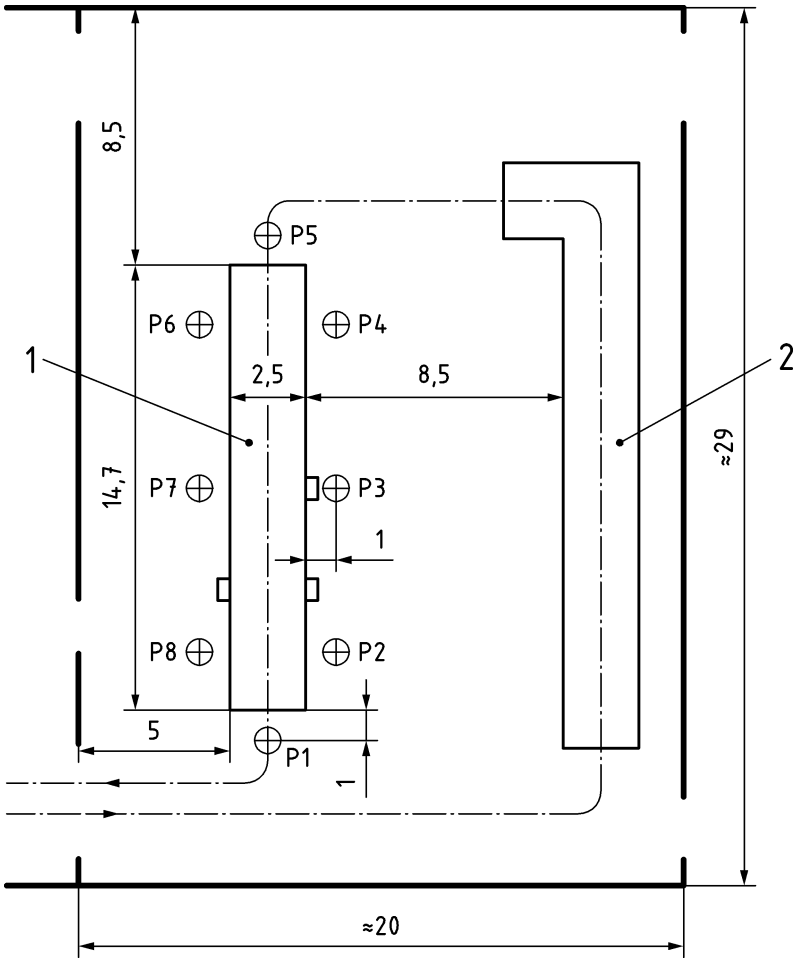
⊕ measurement position

1 reference box

NOTE Arrangement of measurement positions for the determination of emission sound pressure levels ($2a \leq 7$ m, $14 \text{ m} < 2b \leq 21$ m)

Figure C.1 — Arrangement of measurement paths and points

Dimensions in metres



Key

P measurement position

1 recirculation air dryer

2 pre-treatment machine

NOTE Ground plan showing the position of the recirculation air dryer in the room (height of room = 12,0 m) and the measurement positions.

Figure C.2 — Dimensions of room and arrangement of recirculation air dryer within the room, as well as location of measurement positions

Annex D
(informative)

Noise emission determination procedure

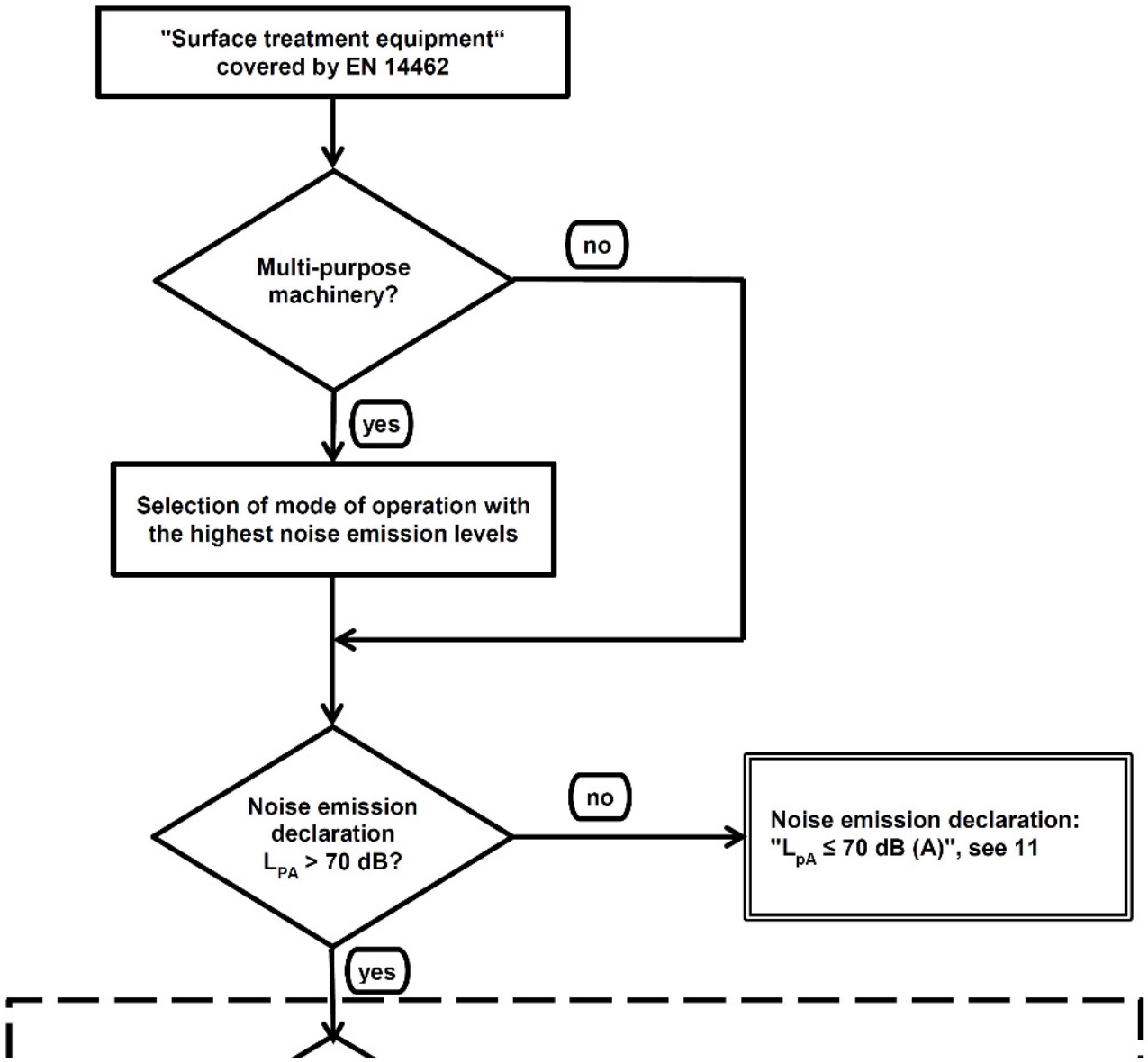


Figure D.1 — Noise emission determination procedure (flowchart part 1 of 2)

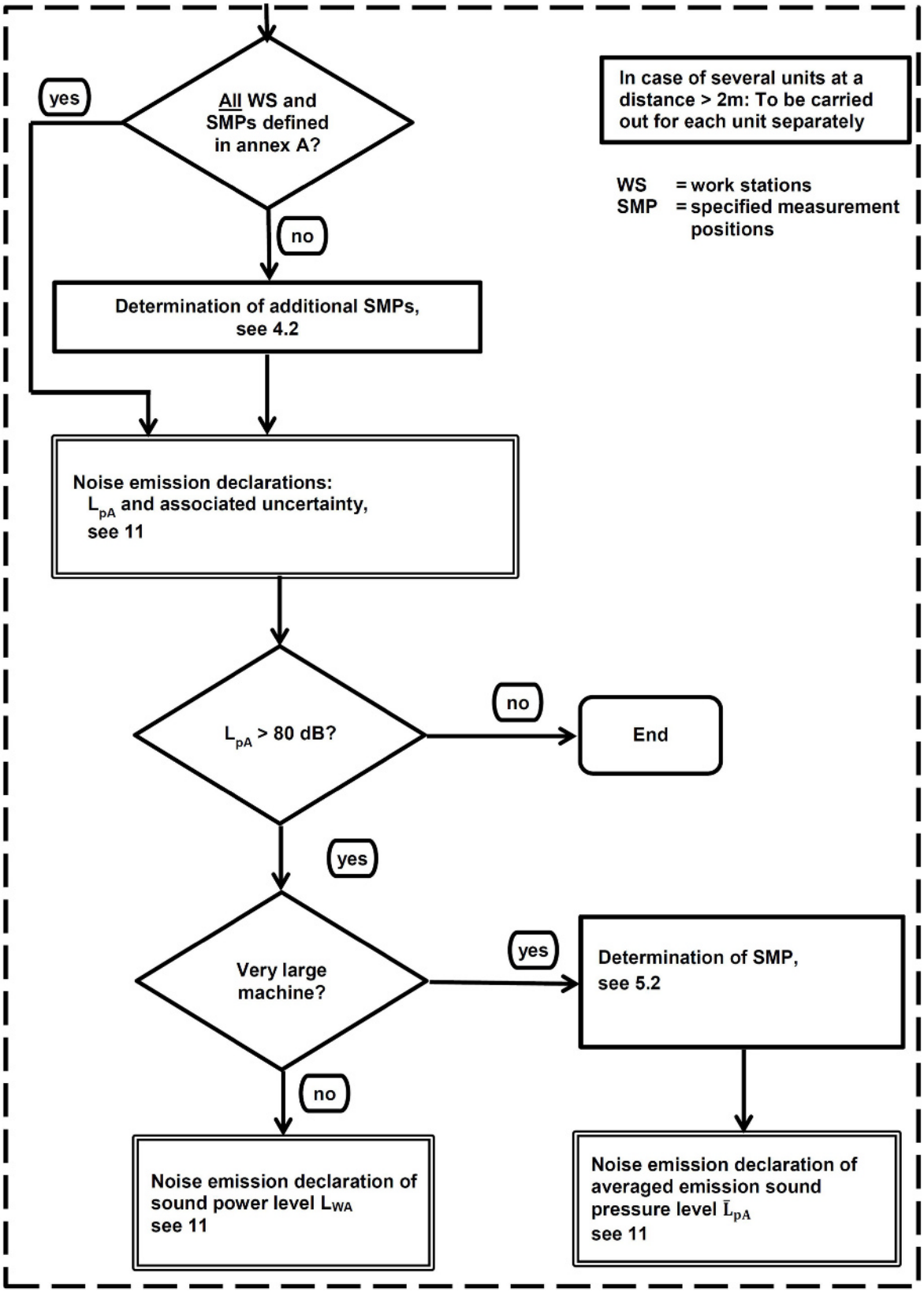


Figure D.2 — Noise emission determination procedure (part 2 of 2)

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the Machinery Directive 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with Essential Requirement 1.7.4.2 (u) and 1.7.4.3 of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

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

[2] EN ISO 3743-1:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for small movable sources in reverberant fields - Part 1: Comparison method for a hard-walled test room (ISO 3743-1:2010)*

[3] EN ISO 9614-1, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points (ISO 9614-1)*

[4] EN 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications (IEC 61672-1)*

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