



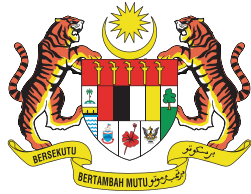
Guidelines for Noise Labelling and Emission Limits of Outdoor Sources

Third Edition



Department of Environment
Ministry of Environment and Water





GUIDELINES FOR NOISE LABELLING AND EMISSION LIMITS OF OUTDOOR SOURCES



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FOREWORD

Assalamualaikum Warahmatullahi Wabarakatuh & Salam Sejahtera

The *Guidelines for Noise Labelling and Emission Limits of Outdoor Sources* hereby published by the Department of Environment is a new publication to supersede the previously published *Planning Guidelines for Noise Labelling and Emission Limits of Outdoor Sources* (first edition 2004 and second edition 2007).

The preparation of this new Guideline was done as part of the updating of the Planning Guidelines for Environmental Noise and Vibration undertaken in the Ambient Noise Study Project by the Department of Environment (DOE) in 2017. This Guideline for noise labelling and emission limits is an updated publication with revisions resulting from review and adoption of current revisions of international standards in noise emission measurements and noise ratings. The revisions include amendments consistent with the most current Directives of the European Union (Directive 2000/14/EC for example) relating to noise emission in the environment by equipment for outdoor use. The publication of this Guideline is in line with the Department's responsibility for ensuring sustainable development in the course of national development while ensuring clean, healthy and safe environment in the country.

Consistent with DOE's role as a disseminator of information and promoter for continual appreciation of the natural environment in addition to its other roles, this Guidelines promotes self-regulation by the industries and other stakeholders in environmental noise & vibration management. The self-regulation and proactive measures in monitoring and mitigation of environmental noise & vibration are to support environmental, social and governance (ESG) initiatives required by parties responsible for the noise & vibration sources with impact to the environment and community.

I would like to acknowledge the expert contribution of the Institute of Noise & Vibration Universiti Teknologi Malaysia, in particular Professor Dr. Mohd Salman Leong, the relevant agencies and all other individuals in providing the input, comments and recommendations in the preparation and publication of this Guidelines.



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GUIDELINES FOR NOISE LABELLING AND EMISSION LIMITS OF OUTDOOR SOURCES

Third Edition 2021

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1.0 SCOPE

- 1.1 This document presents technical guidance and recommendations for:
 - (a) specifying noise emission levels and noise labeling requirements.
 - (b) procedures for measurement and labeling of noise emission of outdoor noise sources; and
 - (c) noise parameters for the description of noise emission of outdoor noise sources.
- 1.2 For purpose of these Guidelines, definitions used are consistent with those given in ISO 3740:2019, ISO 3746:2010, ISO 3744:2010, ISO 7574-3:1985, and the European Community Council Directives on noise labeling.
- 1.3 The guidelines present a comprehensive and unambiguous manner upon which noise emission from outdoor noise sources could be measured and reported.

2.0 PURPOSE

- 2.1 The purpose of this guidelines is:
 - (a) to present a uniform method in the measurement and labeling of outdoor noise sources; and
 - (b) to prescribe maximum permissible sound emission levels for a variety of outdoor noise sources for the protection of the public from excessive noise.
- 2.2 The guidelines should be used in specifying sound emissions levels of equipment to be used in a project and/or for procurement of equipment.

3.0 LEGISLATIVE RELEVANCE

- 3.1 Section 23 under the Environmental Quality Act 1974 stipulates that “*no person shall, unless licensed, emit or cause or permit to be emitted any noise greater in volume, intensity or quality in contravention of the acceptable conditions specified under section 21*”.
- 3.2 The Environmental Quality (Motor Vehicle Noise) Regulation 1987 stipulate permissible noise emission from motor vehicles, and procedures for the measurement of such noise emission.
- 3.3 The Department of Environment in these Guidelines present recommendations upon which acceptable noise emission limits and noise labeling could be specified for outdoor noise sources. These noise sources are for construction and industrial equipment commonly used outdoors. Sound emission from outdoor sound systems is also included. Noise emissions from motor vehicles are not included here as this is enforced under the Motor Vehicle Noise Regulation 1987.
- 3.4 This Third Edition of the guidelines supersede the first edition of 2004 and 2007 Reprint.

4.0 USE OF NOISE LABELLING

- 4.1 Noise labelling information is intended for:
- caution project proponents and/or users and purchasers about the noise emission level of equipment and outdoor work activities and help them to compare or select quieter machines.
 - enable project proponents and users of machines or originator of activities to plan noise control strategies including plant layout, to protect the general public and workers against exposure to excessive noise.
 - give advance notice to project proponent and users of machine that noise level in the environment should be monitored when new machines or equipment are introduced.
 - warn machines operators that they may be exposed to excessive noise, and hence should wear hearing protectors.
- 4.2 The intention of defining an acceptable noise emission limit is to:
- control excessive noise generation at source for the protection of the public from excessive noise pollution.
 - encourage the use of quieter machines and/or implement noise reduction measures on outdoor noise source.

5.0 NOISE EMISSION LIMITS AT SOURCE

- 5.1 Noise emission limits may be set based on either of the following, depending on the type of noise source:
- an absolute limit based on the sound power levels of the machine or equipment.
 - an absolute limit based on the sound pressure levels of the activity or work process measured at a receptor location

- 5.2 The recommended maximum sound power level of airborne noise for compaction machines as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 1.

Compaction machines are typically vibrating rollers, vibratory plates, vibratory rammers as used in construction.

- 5.3 The recommended maximum sound power level of airborne noise for excavators, dozers and loaders, as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 2 based on tracked (tracked dozers, tracked loaders, tracked excavator-loaders) and wheeled types.

Wheeled types include wheeled excavator-loaders, dumpers, graders, loader-type landfill compactors, combustion-engine driven counterbalance lift trucks, mobile cranes, compaction machines (non-vibrating rollers), paver-finishers, and hydraulic power packs.

Builders' hoists for the transport of goods, construction winches and motor hoes which are generically quieter are not covered in this machine's category.

- 5.4 The recommended maximum sound power level of airborne noise for powered hand held concrete breakers and picks, as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 3.
- 5.5 The recommended maximum sound power level of airborne noise for compressors, as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 4.

Compressors subjected to limits prescribed in Schedule 4 are motor-driven devices for circulating and compressing air other than the following two categories of device: fans and blowers, i.e., devices producing air circulation at a positive pressure of not more than 1.1 atmospheric pressure; and vacuum pumps, i.e., devices or appliances for extracting air from an enclosed space at a pressure not exceeding atmospheric pressure.

Industrial gas compressors such as centrifugal or reciprocating compressors driven by a prime mover (turbines, combustion engines, etc.) when measured on its own (i.e., without an enclosure) may exceed sound power levels as prescribed in Schedule 4; but when used and installed in an enclosure shall comply with limits prescribed in Schedule 4.

- 5.6 The recommended maximum sound power level of airborne noise for tower cranes, as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 5.
- 5.7 The recommended maximum sound power level of airborne noise for power generators and welding generators, as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 6.
- 5.8 The recommended maximum sound power level of airborne noise for cooling towers, as measured in accordance with procedures set out in these Guidelines should not exceed levels as prescribed in Schedule 7.
- 5.9 The maximum sound pressure level of airborne noise for piling operations as measured in accordance with procedures set out in this Guideline shall not exceed environmental noise levels as prescribed in Schedule 8.
- 5.10 The maximum permissible sound pressure levels for sound reinforcement systems operated outdoors, typically for outdoor concerts, cultural or musical performances, stage shows, and theme parks as measured under the conditions set out in these Guidelines should not exceed levels as prescribed in Schedule 9.
- 5.11 Sound power levels of any other equipment not stipulated herein in this Guideline outdoors in residential, or noise sensitive areas in principle shall not result in sound pressure levels at the real property boundary exceeding the recommended maximum permissible levels given in the Planning Guidelines for Environmental Noise Limits and Control. This includes all types of industrial, commercial and domestic mechanical ventilation fans, air conditioning chillers and condensing units.

6.0 NOISE LABELLING

- 6.1 Machine tested in accordance with the guidelines prescribed herein should bear a clear and permanent mark (label) indicating the sound power level, in dBA referenced to 1 ρ W, guaranteed by the manufacturer, assembler, distributor and supplier of the machine. An example of a suitable and recommended label is given in Annex A.
- 6.2 Person(s) manufacturing, assembling, distributing, selling and hiring construction and industrial equipment, and any other machines used outdoors are encouraged to conduct sound emission measurements, and to label the sound emission in accordance with these Guidelines.
- 6.3 All projects subjected to an Environmental Impact Assessment shall require project proponents and/or person(s) using construction and industrial equipment, and other machines used outdoors to comply with maximum permissible sound emission levels as recommended in the Guidelines.
- 6.4 The Department of Environment may at its discretion may require sound emission measurements be carried out by an independent testing authority at the costs of project proponent or person(s) responsible for noise sources with noise emissions propagated to the environment.
- 6.5 Local authority may require organizers, promoters or owners of concerts, outdoor performances, theme parks and other outdoor activities with sound reinforcement systems, as a condition in its granting of license(s) for such activities, to comply with maximum permissible sound pressure levels as recommended in the Third Schedule. The local Authority may further require person(s) responsible for the activities to conduct sound measurements by an independent testing authority.

7.0 NOISE MEASUREMENT PROCEDURES

- 7.1 The determination of sound power levels, as required in the noise labeling, shall in general be undertaken in accordance with recommendations of the following measurement standards:
- a. ISO 3740:2019 Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards.
 - b. 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.
 - c. ISO 3746:2020 Acoustics – Determination of sound power levels and sound energy levels noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane.
- 7.2 Sound power levels determination in accordance with ISO 3744:2010 (engineering method) is recommended for noise labeling purpose. Sound power levels determined using precision methods in accordance with BS EN ISO 3745:2012+A1:2017 precision undertaken in acoustic test laboratories is equally acceptable. The verification of sound power levels at site may be undertaken in accordance with ISO 3746:2010 (survey method).
- 7.3 Further guidance and reference to any other available ISO standards that are specific for selected machines and equipment may be necessary. A list of such current ISO standards (relating to outdoor or industrial noise sources) is listed in Annex E. Sound measurement instrumentations, acoustic qualification tests of the testing environment, and accuracy of test results shall be guided by the respective ISO test standards.
- 7.4 Additional supplementary notes on test measurement operating conditions based on recommendations of the European Community Council Directives for specific machines or equipment are given in Annex B.
- 7.5 Sound pressure level measurements for piling operations shall be undertaken in accordance procedures given in Annex C.

Sound pressure level measurements for sound reinforcement systems applicable for outdoor concerts, performance stage, and theme parks shall be undertaken in accordance with procedures given in Annex C, and supplementary notes attached therein.

8.0 GLOSSARY

“**airborne noise emission**” means the “A”-weighted sound power level, L_{WA} , or SWL, emitted by the noise source expressed in decibels (dB) with reference to the sound power of one picowatt (1pW), and transmitted by the air.

“**background noise**” means any noise recorded at the measuring points which are not generated by the sound source.

“**compressor**” means any motor-driven device for circulating and compressing air other than the following two categories of device: fans or appliances for circulation and extracting air at atmospheric pressure.

“**dozers**” means self-propelled wheeled, or crawler machines fitted in front with a blade which serves primarily to displace or spread materials.

“**equivalent A-weighted sound level (L_{Aeq})**” means the constant sound level that, in a given situation and time period, conveys the same sound energy as the actual time-varying A-weighted sound.

“**excavator**” (hydraulic or rope-operated) means machine combining a self-propelled undercarriage with an upper structure which can swivel through more than 360°. The machine excavates, lifts, carries and dumps material by moving a boom, an arm and bucket (as is the case with a face shovel or a backhoe) or a bucket controlled by the winding gear (as is the case with a drag-line or a clamshell).

“**excavator-loader**” means self-propelled wheeled or crawler machine, designed to be fitted with a loading bucket at the front and an excavating arm at the rear as original equipment. The loading bucket loads, raises, transports and dumps material by combining its own movements with those of the machine. The excavating arm excavates, raises and dumps material by movements of the boom, arm and bucket.

“**extraneous noise**” means the noise resulting from background noise and parasitic noise.

“**household appliance**” means any machine, portion of a machine or installation manufactured principally for use in dwellings, including cellars, garages and other outbuildings, in particular household appliances for upkeep, cleaning purposes, preparation and storage of foodstuffs, production and distribution of heat and cold, air conditioning, and other appliances used for non-commercial purposes.

“**impulsive sound**” means sound of short duration, usually less than one second, with an abrupt onset and rapid decay. Without prejudice to the foregoing, examples of sources of impulsive sound shall include but not be limited to pile drivers, drop hammer or driven impacts and explosions.

“**lawnmower**” means all motorised equipment appropriate for the upkeep by cutting, by whatever method, of areas under grass used for recreational, decorative or similar purposes.

“**loader**” means self-propelled wheeled, or crawler machine fitted in front with a bucket. The machine loads, raises, transports and dumps material by combining its own movements and those of the bucket.

“**machine**” means device, equipment or parts of equipment and installation, mechanically or electrically driven or otherwise, as used for any forms of work. This includes construction plant equipment, and all forms of equipment used outdoors.

“**measuring surface**” means a hypothetical surface surrounding the sound source and on which sound measurement points are arranged.

“**person**” means any individual, association, partnership, firm, society or corporation, and includes any officer, employee, department, agency or instrumentality of a State.

“**power generator**” means any device comprising a motor unit driving a rotary generator producing continuous electrical power.

“**real property boundary**” means an imaginary line along the ground surface, and its vertical extension, which separates the real property owned by one person from that owned by another person, but not including intra-building real property divisions, as delineated in the land title appearing in the Certificate of Title.

“**sound or noise emission**” means sound as emitted or discharged from a sound source(s).

“**sound immission**” means sound as propagated onto and received by a receiver from source(s) external to the receiver or real property.

“**sound power**” means the acoustic energy emission radiated by a sound source, expressed in unit of Watts (W).

“**sound power level**” means 10 times the logarithm to the base 10 of the ratio of the sound power to the reference power of 1 pW. The sound power level is denoted L_w or SWL and is expressed in decibels. The sound power level expressed in dB (A) is denoted as L_{WA} or SWL (A).

“**sound pressure**” means the instantaneous difference between the actual pressure and the average or barometric pressure at a given point in space, as produced by sound energy.

“**sound pressure level**” means 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure to the reference pressure of 20 micro Pascals. The sound pressure level is denoted L_p or SPL and is expressed in decibels.

“**sound reinforcement systems**” means any electronic or similar devices which produces, reproduces or amplifies sound.

“**sound source**” means the machine, equipment, installation including its sub-components, sound reinforcement systems including loudspeakers, and other sources from which sound originates.

“**tower crane**” means a power-driven lifting appliance which when in use, consists of a vertical tower with a jib fitted to the upper part; is equipped with means for raising and lowering suspended loads and for horizontal movement of such loads by variation of load-lifting radius and/or by slewing and/or by traveling of the complete appliance.

“**welding generator**” means any rotary device which produces a welding current.

SCHEDULE OF PERMISSIBLE SOUND LEVELS

SCHEDULE 1

MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF COMPACTION MACHINES

Net installed Power P kW	Permissible Sound Power Level L_{WA} dBA ref 1 pW
$P \leq 8$	105
$8 < P \leq 70$	106
$P > 70$	$86 + 11 \log P$

SCHEDULE 2

MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF EXCAVATORS, DOZERS AND LOADERS

Net installed Power P kW	Permissible Sound Power Level dBA ref 1 pW
Tracked excavators, dozers, loaders	
$P \leq 55$	103
$P > 55$	$84 + 11 \log P$
Wheeled excavators, dozers, loaders	
$P \leq 55$	101
$P > 55$	$82 + 11 \log P$

SCHEDULE 3

MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF POWERED HAND HELD CONCRETE BREAKERS AND PICKS

Mass of Appliance m kg	Permissible Sound Power Level L_{WA} dBA ref 1 pW
$m \leq 15$	105
$15 < m \leq 30$	$92 + 11 \log m$
$m > 30$	$94 + 11 \log m$

Note: Permissible sound power levels shall be rounded up or down to the nearest integer number (less than 0.5, use lower number; greater than or equal 0.5, use higher number).

SCHEDULE 4**MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF COMPRESSORS**

Net installed Power P kW	Permissible Sound Power Level L_{WA} dBA ref 1 pW
$P \leq 15$	97
$P > 15$	$95 + 2 \log P$

SCHEDULE 5**MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF TOWER CRANES**

Net installed Power P kW	Permissible Sound Power Level L_{WA} dBA ref 1 pW
Net installed power P of energy generator	$96 + \log P$

SCHEDULE 6**MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF POWER GENERATORS AND WELDING GENERATORS**

Electric Power P_{el} kW*	Permissible Sound Power Level L_{WA} dBA ref 1 pW
$P_{el} \leq 2$	$95 + \log P_{el}$
$2 < P_{el} \leq 10$	$96 + \log P_{el}$
$P_{el} > 10$	$95 \log P_{el}$

* P_{el} for power generators: prime power according to ISO 8528-1:1993, clause 13.3.2

P_{el} for welding generators: conventional welding current multiplied by the conventional load voltage for the lowest value of the duty factor given by the manufacturer.

Note: Permissible sound power levels shall be rounded up or down to the nearest integer number (less than 0.5, use lower number; greater than or equal 0.5, use higher number).

SCHEDULE 7**MAXIMUM PERMISSIBLE SOUND POWER LEVELS OF COOLING TOWERS**

Net installed Fan Power P kW	Permissible Sound Power Level L_{WA} dBA ref 1 pW
$P \leq 60$	105
$P > 60$	108

SCHEDULE 8**MAXIMUM PERMISSIBLE SOUND PRESSURE LEVELS FROM PILING OPERATIONS**

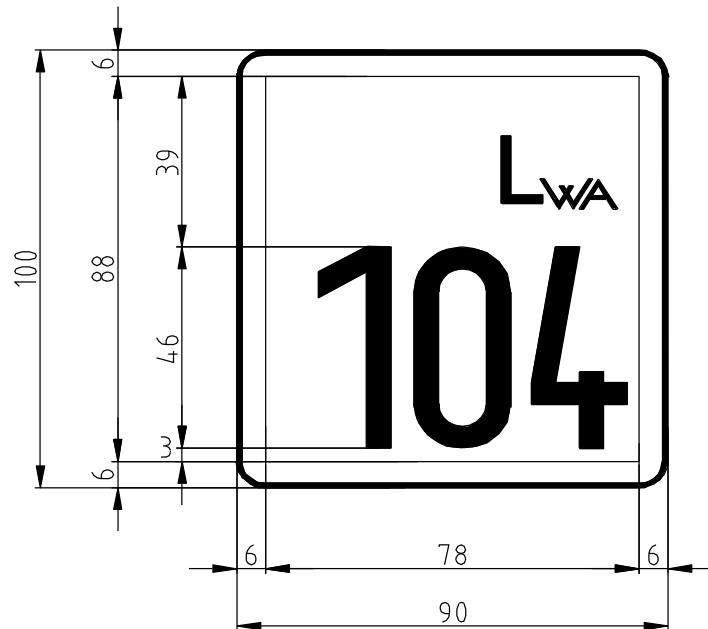
Receiving Land Use Category at property boundary	Noise Parameter	Sound Pressure Level L_{pA} dBA
Residential	L_{10}	75
	L_{max}	90
Commercial	L_{10}	80
Industrial	L_{10}	80

SCHEDULE 9**MAXIMUM PERMISSIBLE SOUND PRESSURE LEVELS FOR SOUND REINFORCEMENT SYSTEMS (APPLICABLE FOR OUTDOOR CONCERTS, PERFORMANCE, STAGE AND THEME PARKS)**

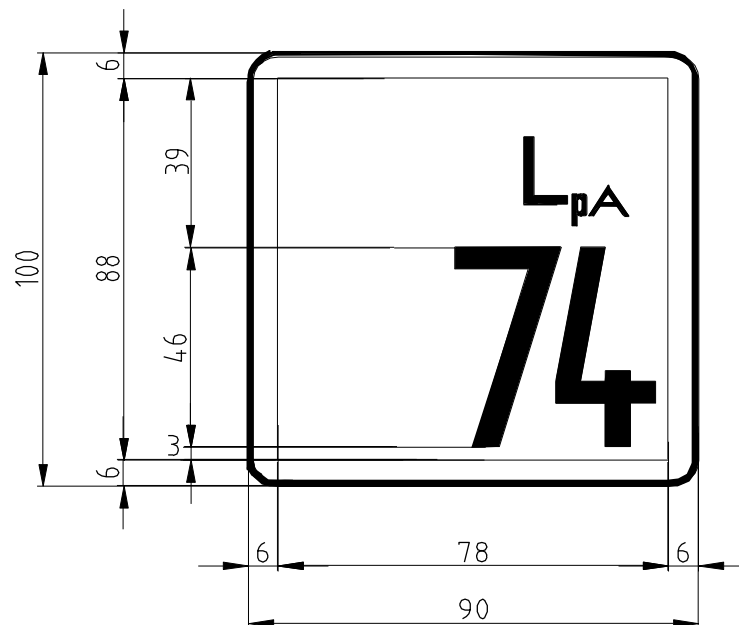
Location	Sound Pressure Level L_{pA} dBA		
	L_{Aeq}	L_{10}	L_{max}
At Stage or Pavilion (at source)	95	100	110
At Audience (at perimeter of terraces)	85	90	100

ANNEX A

NOISE LABEL STATING SOUND POWER AND SOUND PRESSURE LEVEL



(a) Sound Power Level, dBA



(b) Sound Pressure Level, dBA at Machine Operator's position

ANNEX B

SUPPLEMENTARY NOTES ON MEASUREMENT CONDITIONS FOR SPECIFIC MACHINES

The acoustic parameter describing airborne sound emission of machines in these Guidelines is basically based on sound power levels. The determination of sound power levels shall generally be based on procedures laid out in the ISO standards: ISO 3740:2019, ISO 3744:1995 and ISO 3746:2010.

Supplementary procedures and/or provisions unique to specific machines may be appropriate to ensure uniformity of operating conditions upon which the sound power levels are rated. These procedures and/or provisions are summarized below.

1. **Compaction machines**

- (a) Vibrating rollers for ride-on operators shall be installed on one or more appropriate elastic materials(s) such as air cushion(s), and inflated to ensure the machine is elevated by at least 5 cm. The machine shall be tested in a stationary position with the engine at rated speed and the moving mechanism(s) disconnected. The compacting mechanism shall be operated using the maximum compaction power corresponding to the combination of the highest frequency and highest possible amplitude for that frequency as declared by the manufacturer.
- (b) Vibratory plates, vibratory rammers, explosive rammers and walk-behind vibrating rollers shall be tested under load as per operating conditions in accordance with EN 500-4 rev. 1:1998, Annex C.
- (c) Additional guidance is given in the European Community Council Directive 2000/14/EEC.

2. **Excavators, dozers, loaders**

- (a) Sound power determination of excavators, dozers and loaders shall be undertaken in accordance with EN ISO 3744:2010 and EN ISO 6395:2008 with operating conditions during test in accordance with ISO 6395:2008 with additional reference to European Community Council Directive 2000/14/EEC, Part B Clause 16 to Clause 23.
- (b) The machines are in general tested in a stationary position. The engine driving the equipment shall operate at the speed that causes the maximum output of the equipment specified. In the event that airborne noise emissions under conventional working conditions are required, the dynamic test method of measurements is preferred undertaken in accordance with ISO 6396:2008.

3. Powered hand held concrete breakers and picks

- (a) All appliances shall be tested in the vertical position. If the test appliance has an air exhaust, its axis shall be equidistant from two microphone position, The noise of the power supply shall not influence the measurement of the noise emission from the tested appliance.
- (b) The appliance shall be coupled during the test to a tool embedded in a cube-shaped concrete block placed in a concrete pit sunk into the ground. This concrete test block characteristics, supports of the concrete breakers and picks shall be in accordance with specifications described in Part B Clause 10 of the European Community Council Directive 2000/14/EEC.

4. Compressors

- (a) The compressors shall be installed on the reflecting plane; skid-mounted compressors shall be place on a support 0.40m high, unless otherwise required by the manufacturer's conditions of installation.
- (b) The determination of sound power level shall be made at full-load or in an operating condition that is reproducible and is representative of the noisiest operation of typical usage of the machine under test, whichever is the noisier.
- (c) During testing, no tools shall be coupled to the compressor. Care shall be taken to ensure the noise generated by the gas being exhausted is at least 10dB lower than the noise to be measured at all measurement locations (e.g., by the fitting of a silencer).
- (d) Additional guidance is given in European Community Council Directive 2000/14/EEC.

5. Tower Cranes

- (a) Measurements shall be carried out at ground level. The measuring surface to be used for the ground-level test shall be a hemisphere. The center of the hemisphere shall be the vertical projection on the flat reflecting surface of the geometric center of the frame of the lifting mechanism of the energy generator or of the two combined.
- (b) Additional guidance on test conditions and measurement requirements shall be in accordance with procedures prescribed in Part B, Clause 53 of the European Community Council Directive 2000/14/EEC.

6. Power generators and Welding generators

- (a) The welding generator shall be installed on the reflecting plane; skid mounted welding generators shall be placed on a support 0.40 m high, unless otherwise required by the manufacturer's conditions of installation. The welding generator shall be tested under load in accordance with ISO 8528-10:1998.
- (b) The welding generator shall be installed on the reflecting plane; skid mounted welding generators shall be placed on a support 0.40 m high, unless otherwise required by the manufacturer's conditions of installation. The welding generator shall be tested under load in accordance with ISO 8528-10:1998.
- (c) Additional guidance is given in European Community Council Directive 2000/14/EEC.

7. Cooling Towers

- (a) The cooling tower shall be installed on the reflecting plane; skid mounted welding generators shall be placed on a support 0.40 m high, unless otherwise required by the manufacturer's conditions of installation.
- (b) Measurement procures shall be undertaken in accordance with ISO 3744:2010 with a hemispherical measurement surface.
- (c) The sound measurement points shall include air intake on all sides and discharge. Near field measurement points shall be at 1.5m distance away from the sides at 1.5m height on all four sides, and 1.5m height at the center at the top of the cooling tower. Far field measurement positions shall be at 15m distance away 1.5m height at the sides, and 15m height above the cooling tower at the top.
- (d) The cooling tower shall operate in accordance with manufacturer's recommendations at rated capacity of the cooling tower under load.

ANNEX C

METHOD OF MEASUREMENT OF AIRBORNE SOUND EMISSION OF OUTDOOR NOISE SOURCES (PILING OPERATIONS AND SOUND REINFORCEMENT SYSTEMS)

1. Purpose

The purpose of this procedure is to determine the noise emitted from piling operations and from all categories of sound reinforcement systems used outdoors.

2. Scope

This method is applicable to any type of piling operations in construction sites, etc., and from sound electronically amplified or reproduced from musical instruments, human voice and other sound reproduction materials.

Due to the diversely different nature of the above noise sources, supplementary notes are given for measuring conditions specific for the noise source.

3. Measuring instruments

3.1 Measuring apparatus

The measurement shall be made with a precision sound level meter which comply with the requirements of the IEC 61672-1 or latest revision Class 1 for the type of meters; and conform to IEC 60651 Class 1, IEC 60804 Class 1.

3.2 Inspection of the measuring apparatus

- (a) Before the tests, the acoustic properties of the entire apparatus (measuring instruments including microphone and cable) shall be checked by means of a calibrated sound source with an accuracy of at least 0.5 dB (e.g., a piston phone).
- (b) The above measurement site calibration checks shall be supplemented by laboratory calibration in an accredited laboratory or standards institution.

3.3 Weighting network

Use shall be made of an A-weighting network meeting the requirements of IEC publication.

3.4 Statistical analysis

The sound level meter or combinations of instruments, such as real time analyzers, shall be fitted with statistical analysis functions to derive statistical centile sound pressure levels (ten percentile level L_{10} , ninety percentile level L_{90}), the maximum instantaneous sound pressure level L_{max} , and equivalent sound pressure level L_{Aeq} over the prescribed measuring time period.

4. Measuring condition for sound emissions from piling operations

4.1 Piling operations

Measurements shall be undertaken for the duration of the piling operation of a single pile length under worst case conditions of ground penetration rated at the operational impact energy per blow fitted with the operational dolly.

Measurements shall be repeated to cover different soil conditions and/or source receiver distances.

4.2 Measurement site

Measurements for operations from piling machines shall be carried out at ground level at the real property boundary of the receiver.

5. Measuring conditions for sound emission from sound reinforcement systems

5.1 Operation of all loudspeakers and sound amplification equipment

With an intent of evaluating actual operational conditions, all sound amplification equipment shall be operational, and all loudspeakers activated (i.e., patched into the sound reinforcement system).

The entire sound reinforcement system(s) which forms the integral sound sources to be tested shall be operated with the actual operation media of sound reproduction or reinforcement (i.e., live band music, human voice, pre-recorded media, etc. as the case may be).

All electronic gain control settings (sound intensity, volume control etc.) of the power amplifiers, mixing consoles, line outputs, etc. shall be at the full operational levels.

The sound sources (loudspeakers clusters, stage frontal loudspeakers, monitor speakers, etc.) shall be installed in its normal operational location and orientation on site.

The results of a measurement shall be valid only for the combination tested.

5.2 Measurement locations

Measurements shall be undertaken at the stage, pavilion and source location, including main loudspeaker clusters (at distance not less 3 meter); and at the audience or public areas (as the case may be).

6. Measurement

6.1 Measurement of the acoustic properties of the measuring site

The environment conditions at the measuring site shall be checked before measurements are carried out. The following factors shall be checked:

- (a) extraneous and other activity noise unrelated to the noise source of interest.
- (b) wind interference.
- (c) operating conditions such as temperature, humidity, barometric pressure.

Corrections for extraneous noise shall be undertaken if and only if this noise is deemed not representative of the site (for example construction activities).

6.2 Measurement of sound pressure levels (L_{Aeq} , L_{max} , L_{10})

Continuous noise monitoring of the sound emissions of the noise source over the complete duration of the sound source generation shall be undertaken. For practical convenience, monitoring in regular time period segments (e.g., hourly segments repeated over different time period) is also acceptable.

Statistical analysis of the instantaneous sound pressure levels over the monitoring period shall be undertaken to obtain the statistical centile levels of L_{10} (ten percentile level). The maximum instantaneous level L_{max} over the monitoring period shall also be noted. The equivalent A weighted sound pressure level L_{Aeq} over the monitoring time period shall also be measured.

7. Data to be reported

The following information shall be compiled and recorded in a report concerning all measurements made with respect to these Guidelines.

7.1 Sound sources under test

- (a) Piling operations
 - Description of piling method or system, and/or type of piles;
 - Pile depth(s) for which noise levels were measured; and
 - Soil condition.
- (b) Sound Reinforcement System
 - Description of the sound reinforcement system under test, including rated power output of sound amplification devices, and loudspeaker ratings.
 - Operating conditions of the sound reinforcement systems (gain control settings, line inputs - voice, music, live band, etc.).
 - Location and elevation of sound sources (loudspeakers, including remote distributed loudspeakers) and its proximity to adjoining properties.

7.2 Acoustic environment

- (a) Description of the measuring site; diagram showing the location of sound sources and any reflecting or screening surfaces on the measuring site.
- (b) Meteorological conditions.

7.3 Instrumentation

- (a) Equipment used for the measurements, including the name of the equipment, type, serial number and name of manufacturer.
- (b) Method used to calibrate the measuring equipment in accordance with Para 3.2.

7.4 Acoustic data

- (a) Equivalent “A” weighted sound pressure level (L_{Aeq}) for the time period of measurement.
- (b) A-weighted statistical centile levels L_{10} at the time period of measurement.
- (c) Maximum instantaneous sound pressure level (L_{max}) for the time period of measurement.
- (d) Measurement time duration.

ANNEX D

EXAMPLES IN SPECIFYING PERMISSIBLE SOUND POWER LIMITS

Examples in determining the numerical values of maximum permissible sound power levels of different machine's types based on the machines power ratings, mass, etc., in accordance with recommendations of the respective Schedules are given below.

Permissible levels shall be rounded up or down to the nearest integer number (less than 0.5, use lower number; greater than or equal 0.5, use higher number).

#	Type of Equipment	Net installed Power P kW	Permissible Sound Power Level L_{wA} dBA	Net installed Power P kW	Permissible Sound Power Level L_{wA} dBA	
1	Compaction machines: vibrating rollers, vibratory plates, vibratory rammers	$P \leq 8$	105	6 kW		
		$8 < P \leq 70$	106	55 kW		
		$P > 70$	$86 + 11 \log P$	95 kW	$L_{wA} = 86 + 11 \log(95) = 107.75$	108 dBA
2	Tracked dozers, tracked loaders, tracked excavator-loaders	$P \leq 55$	103	55 kW		
		$P > 55$	$84 + 11 \log P$	80 kW	$L_{wA} = 84 + 11 \log(80) = 104.93$	105 dBA
3	Wheeled dozers, wheeled loaders, wheeled excavator-loaders, dumpers, graders, loader-type landfill compactors, mobile cranes, compaction machines (non-vibrating rollers), paver-finishers, hydraulic power packs	$P \leq 55$	101	50 KW		
		$P > 55$	$82 + 11 \log P$	80 kW	$L_{wA} = 82 + 11 \log(80) = 102.93$	103 dBA
4	Compressors	$P \leq 15$	97	10 kW		
		$P > 15$	$95 + 2 \log P$	20 kW	$L_{wA} = 95 + 2 \log(20) = 97.60$	98 dBA
5	Ventilation fans, extract fans, blowers.	$P \leq 60$	105	50 kW		
		$P > 60$	108	100 kW		108 dBA
6	Tower cranes	Installed power P of energy generator	$96 + \log P$	90 kW	$L_{wA} = 96 + \log(90) = 97.95$	98 dBA
				200 KW	$L_{wA} = 96 + \log(200) = 98.30$	98 dBA

#	Type of Equipment	Net electric Power P_{el} kW	Permissible Sound Power Level L_{wA} dBA	Net electric Power P_{el} kW	Permissible Sound Power Level L_{wA} dBA
7	Welding and power generators	$P_{el} \leq 2$	$95 + \log P_{el}$	1.8 kW	$L_{wA} = 95 + \log(1.8) = 95.26$ 95 dBA
		$2 < P_{el} \leq 10$	$96 + \log P_{el}$	10 kW	$L_{wA} = 96 + \log(10) = 97.00$ 97 dBA
		$P_{el} > 10$	$95 + \log P_{el}$	150 kW	$L_{wA} = 95 + \log(150) = 97.18$ 97 dBA
#	Type of Equipment	Mass of appliance m kg	Permissible Sound Power Level L_{wA} dBA	Mass of appliance m kg	Permissible Sound Power Level L_{wA} dBA
8	Hand-held concrete-breakers and picks	$m \leq 15$	105	15 kg	105 dBA
		$15 < m \leq 30$	$92 + 11 \log m$	20 kg	$L_{wA} = 94 + 11 \log(35) = 108.31$ 108 dBA
		$m > 30$	$94 + 11 \log m$	35 kg	$L_{wA} = 94 + 11 \log(35) = 110.98$ 111 dBA

The above examples showed how the power ratings of the equipment, and for generators the net electric power, and mass of hand-held concrete breakers and picks, are used in maximum permissible sound power levels of the equipment.

The permissible limits as prescribed in the Schedules are consistent and international acoustic test standards and best practices (European Union EEC Directives which are current as of this DOE 3rd edition publication date). Procurement of equipment complying with the prescribed permissible sound power levels would be consistent with readily available equipment in the international market and best practices.

ANNEX E

STATUTORY INSTRUMENTS, STANDARDS AND DIRECTIVES

Statutory instruments in Malaysia

(1) The Environmental Quality Act

Under the Environmental Quality Act, 1974 (Amendment), 1985, there are several provisions that could be utilized to control and abate the noise pollution problems. The following are statements of the Environmental Quality Act, 1974.

Section 21:

The Minister, after consultation with the Council, may specify the acceptable conditions for the emission of noise into any area, segment or element of the environment and may set aside any area, segment or element of the environment within which the emission is prohibited or restricted.

Section 23:

1. No person shall, unless licensed, emit or cause or permit to be emitted any noise greater in volume, intensity or quality in contravention of the acceptable conditions specified under section 21.
2. Any person who contravenes subsection (1) shall be guilty of an offence and shall be liable to a fine not exceeding five thousand ringgit or to imprisonment for a period not exceeding one year or to both and to a further fine not exceeding five hundred ringgit a day for everyday that the offences is continued after a notice by the Director General requiring him to cease the act specified therein has been served upon him.

Section 8A:

The Director General or any other officer duly authorized by him, has the power to test and prohibit use of vehicle.

Section 51:

The Minister after consultation with the Council may make regulations for or with respect to:

- (i) prohibiting the use of any equipment, facility, vehicle, or ship capable of causing pollution or regulating the construction, installation or operation thereof so as to prevent or minimize pollution, and
- (ii) defining objectionable noise and prescribing standards for tolerable noise.

(2) Environmental Quality (Motor Vehicle Noise) Regulation, 1987

This regulation stipulates permissible noise emission from motor vehicles as measured in accordance with procedures stated here in the regulations.

(3) Local Government Act 1976

The Local Government Act 1976 and the various Town Board Enactment also contain provisions enabling due action to be taken against, including prosecution of owners or occupiers of premises, whether public or private, emitting noise that are deemed to be a nuisance. For quantifying the acceptable noise levels, limits based on the best judgment of these Authorities had been used. Noise limits to be used by these Authorities could now be based on these Guidelines.

(4) Minor Offences Ordinance 1953

Minor Offences Ordinance 1953 prohibits noise after 11.00 p.m., and the police are empowered to act forthwith on complains. Annoyance and nuisance could be assessed based on procedures presented in this guideline.

(5) Civil Aviation Act

Under the Civil Aviation Act, aircraft and airport authorities are absolved from paying compensation for nuisance noise only if the aircraft and airport authorities are operated in conformance with international civil aviation procedures.

(6) Occupational Safety and Health (Noise Exposure) Regulations 2019

The Occupational Safety and Health (Noise Exposure) Regulations came into force on 1 June 2019 superseding the Factories and Machinery Act (Noise Exposure) Regulations 1989. The Regulations are aimed at minimizing workers exposure to noise in the workplace. These Regulations stipulate maximum allowable noise exposure limits with stipulated maximum allowable noise levels and personal noise dose. The Regulations also prescribe actions required of the Employer for workers occupational safety and health related to noise in the workplace.

ANNEX E

STANDARDS AND EEC DIRECTIVES

ISO STANDARDS

ISO 1680:2013 Acoustics – Test code for the measurement of airborne noise emitted by rotating electrical machinery

ISO 2151:2004 Acoustics – Noise test code for compressors and vacuum pumps – Engineering method (Grade 2)

ISO 4412-1:1991 Hydraulic fluid power – Test code for determination of airborne noise levels – Part 1: Pumps

ISO 4412-2: 1991 Hydraulic fluid power – Test code for determination of airborne noise levels – Part 2: Motors

ISO 4412-3: 1991 Hydraulic fluid power – Test code for determination of airborne noise levels – Part 3: Pumps – Method using a parallelepiped microphone array

ISO 4872:1978 Acoustics – Measurement of airborne noise emitted by construction equipment intended for outdoor use – Method for determining compliance with noise limits

ISO 5131:2015 Tractors and machinery for agriculture and forestry – Measurement of noise at the operator's position – Survey method

ISO 6393:2008 Earth-moving machinery – Determination of sound power level - Stationary test condition

ISO 6394:2008 Earth-moving machinery – Determination of emission sound pressure level at operator's position – Stationary test conditions

ISO 6395:2008 Earth-moving machinery – Determination of sound power level - Dynamic test conditions

ISO 6396:2008 Earth-moving machinery – Determination of emission sound pressure level at operator's position - Dynamic test conditions

ISO 6798-1:2020 Reciprocating internal combustion engines – Measurement of sound power level using sound pressure – Part 1: Engineering method

ISO 7182:1984 Acoustics – Measurement at the operator's position of airborne noise emitted by chain saws

ISO 7216:2015 Agricultural and forestry tractors – Measurement of noise emitted when in motion

ISO 7917:1987 Acoustics – Measurement at the operator's position of airborne noise emitted by brush saws

ISO 8528-10:1998 Reciprocating internal combustion engine driven alternating current generating sets – Part 10: Measurement of airborne noise by the enveloping surface method

ISO 9207:1995 Manually portable chain-saws with internal combustion engine – Determination of sound levels – Engineering method (grade 2)

ISO 10302-1:2011 Acoustics – Measurement of airborne noise emitted, and structure-borne vibration induced by small air-moving devices- Part 1: Airborne noise measurement

ISO 10494:2018 Gas turbines and gas turbines sets – Measurement of emitted airborne noise – Engineering/survey method

ISO 10884:1995 Manually portable brush-cutters and grass-trimmers with internal combustion engine – Determination of sound power levels – Engineering method (Grade 2)

ISO 11094:1991 – Acoustics – Test code for the measurement of airborne noise emitted by power lawn movers, lawn tractors, lawn and garden tractors, professional mowers and lawn and garden tractors with mowing attachments

EEC DIRECTIVES

Council directive 78/1015/EEC of 19 December 1978 on the approximation of the laws of the Member States relating to the determination of the noise emission of construction plant and equipment.

Council Directive 84/533/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of compressors.

Council Directive 84/534/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of tower cranes.

Council Directive 84/535/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of welding generators.

Council Directive 84/536/EEC of 17 September 1984 on the approximation of the laws of the Members States relating to the permissible sound power level of power generators.

Council Directive 84/537/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of powered hand-held concrete-breakers and picks.

Council Directive 84/538/EEC of 17 September 1984 on the approximation of the laws of the Member States relating to the permissible sound power level of lawnmowers.

Council Directive 86/594/EEC of 1 December 1986 on airborne noise emitted by household appliances.

Council Directive 86/662/EEC of 22 December 1986 on the limitation of noise emitted by hydraulic excavators, rope-operated excavators, dozers, loaders and excavator-loaders

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

Council Directive 2005/88/EC of 14 December 2005 amending Directive 2000/14/EC on the approximation of the laws of the Members States relating to the noise emission in the environment by equipment for use outdoors



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