



Measurement protocol for machine rooms and unmanned enclosed industrial spaces

1 Scope

This protocol can be used to access noise levels in machine rooms and (unmanned) industrial spaces in order to make maps of noise levels or monitor noise levels during any transitions such as renovation and rebuilding or any (other) kind of verification. The protocol is intended for use in (enclosed) spaces which are normally not, or scarcely, occupied by working personnel.

It is specially, but not exclusively, intended to be used for rooms and spaces with relatively large stationary machines, or where machines are a part of the building or structure such as a large pumping station, a turbine room, off-shore rig or an indoor process installation, e.g. where a free field is not relevant and/or not present.

In spaces where personnel is frequently present it can be useful to sketch a noise map, but exposure to potentially harmful noise is preferably investigated using EN-ISO 9612. Noise maps can be used for accessing exposure according to EN-ISO 9612, but only if the workers involved have no fixed positions nor use any gears or tools that produce relevant sound levels, e.g. in cases where the levels determined using this protocol are representative for the performance of a task.

The protocol can be used with survey and engineering uncertainty

2 Measurement positions

- 2.1 Measurement positions are preferably limited to accessible areas
- 2.2 The measurement height is $1,55 \pm 0,075$ m (as in ISO 11201) above the floor, gangway or likewise
- 2.3 The minimum distance to walls and reflecting objects is 1 meter
- 2.4 In any enclosed space the minimum number of measurement positions is 3, unless other requirements of this clause make that not feasible
- 2.5 At least one measurement position is used for each 100 m^2 (accessible area)
- 2.6 Measurement positions are as equally as possible spread over the (accessible) surface;
- 2.7 Dominant or concentrated sources are taken into account by at least one measurement close to this source, with a minimum distance of 1 meter
- 2.8 The highest allowable difference in measured level between any adjacent measurement position is 6 dB for survey accuracy or 3 dB for engineering accuracy. If these differences are exceeded the amount of measurement positions must be increased until this requirement is met.
- 2.9 Positions at consoles, control panels or instruments, inspection windows and communication posts must always be included, even if requirement 2.3 is not met. In cases where 2.3 is not met this must be recorded.

3 Operating conditions

The measurements are conducted during sufficiently defined, and as representative as possible operating conditions. More than one operating condition may be required.

4 Measurand and measurement time

The A-weighted equivalent sound pressure level (L_{Aeq}) must always be determined. If required the C-weighted peak level is determined additionally. Related standards or requirements may ask for additional measurands such as C-weighted equivalent sound pressure level (L_{Ceq}).

The measurement time is at least 10 seconds on any measurement positions, and in total at least 60 seconds for any single room. If strong fluctuations occur the measurement time must be long enough to stabilise the reading of the equivalent level to 0,1 dB within a 5 second period. If the level is cyclic the measurement time is at least (exact) one cycle or an exact multiple, and for each room the measurement time is at least five full cycles.

5 Tonal noise

If tonal components are audible extra attention is needed to local variations in level caused by standing waves. If needed the microphone is displaced slowly with sweeping motion. The measurement time must be adjusted correspondingly. The application of any penalties on the level depending on tonality is not covered in the protocol.

6 Measurement instrument

The sound pressure level meter must comply with IEC 61672-1. For survey accuracy a class 2 meter will be sufficient, for engineering accuracy a class 1 meter is required.

The sound pressure level meter must be checked with a acoustic calibrator before and after the measurement session, and if needed, also during the session, depending on its duration and change of climate (beware for high temperature changes for example).

In case of engineering accuracy the meter and calibrator must be calibrated using traceable standards with an interval of 1 and 2 years respectively by a qualified laboratory.

7 Report requirements

The report gives a declaration of all details of all relevant measurements, mentioning location, date, levels, durations of each measurement and settings of the instruments as far as relevant. End results, for example levels printed on a map, must be rounded to the nearest whole decibel.

Operating conditions must be described as unequivocally as possible. If details of the operating condition(s) are relevant to noise levels they must be mentioned.

If maps are made all levels on the map are accompanied by any kind of reference to the detailed results, or the calculation from details results.

The report contains all details of the used meter(s) and calibrator, e.g. brand, type and serial numbers. In case of engineering accuracy the date and number of the calibration report must be stated.

Many situations can limit the possibilities to comply with clauses 2, 3 and 4. When this is the case it will be mentioned and motivated in the report.

8 Interpretation

- 8.1 Norsok limits for noise in room apply to the measurement point with the highest sound level when operating according to clause 2 of this protocol (Norsok S-002 clause 5.5.2.0-5)

9 Related standards:

ISO 9612	Determination of occupational noise exposure
ISO 2923	Measurement of noise on board vessels
ISO 11200 series	Noise emitted by machinery and equipment
NORSOK S-002	Working environment
NORSOK S-005	Machinery - working environment analyses and documentation

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