Name: Swati Verma Section: C

Registration No.:200906448 Roll No.: 66

Permissible limits of noise level for rotating electrical machines – IS 12065 (1997).

Question: Submit a brief report on rotating machinery standards and refer any national or international standards.

Standard briefed in this report**: IS 12065(1997)**. Permissible limits of noise level for rotating electrical machines [ETD 15: Rotating Machinery]

Introduction:

This Indian standard defines the scope of noise produced by rotating electrical machines on two conditions – on load and on no-load.

The first clause discusses the methods of evaluating the scope of the noise produced by a rotating electrical machine on no-load. Subsequently, the second appendix discusses the methods for evaluating noise produced by a rotating electrical machine on load. This standard also defines noise classification in decibels as well as correcting the disturbance caused by pure tones. This standard however only describes the sound limit for the machines up-to 16MW. Readers should also make note that the measurements made in this standard are assumed in free-field conditions although it also gives recommendations for the machine operating in semi-reverberant conditions.

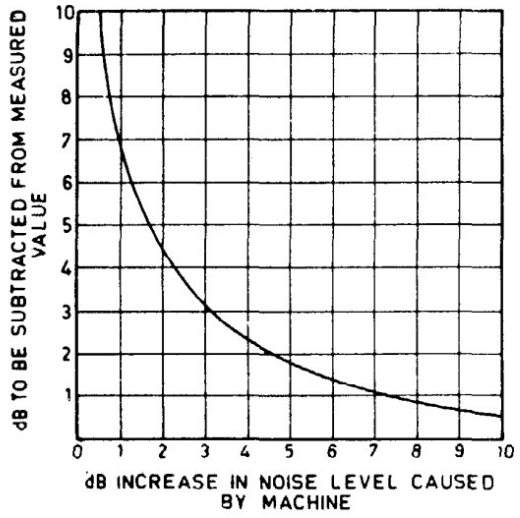


FIG. 1 BACKGROUND NOISE CORRECTION CURVE

Before moving on to the test conditions, it defines various terms and definitions. These are sound pressure level, sound level, noise spectrum, band pressure level, sound power level, prescribed path, equivalent hemisphere, background noise and acceptability rating.

Test Conditions:

The first test conditions describe the method of measuring weighted sound power level of the machine. It is assumed that the machine is a noise source radiating in free-field conditions over a reflecting plane which is considered as its base. Where free-field conditions cannot in practice be achieved, the method may still be used but the sound power level obtained will be slightly higher. In all cases where the weighted sound power level of a machine is greater than 93 dB or one or more tones are prominent, noise measurements shall be made in accordance with Test Method two.

The standard defines the test conditions necessary to be undertaken for conducting the test. Which includes setting up the suitable test environment and measuring the difference between the background noise and the machine noise. The preferred noise difference is 10db and adjustments are made in the case otherwise. The next clause defines the operating conditions for the test, some of which being: -

The machine should run on no-load. Synchronous machines shall be run at unity power factor. The machine shall be in its fully assembled condition, and uncoupled, ac machines shall be supplied at rated voltage and frequency. Machines should be run as nearly as possible at rated speed, or at the highest speed in the range. Structure borne vibrations from a machine to its mounting, or other parts of the test room, can influence the sound pressure level in the test room. It is permissible to minimize such effects by mounting the machine on suitably designed resilient mountings.

As for the measuring instruments used, the sound level meter is to comply according to the requirements of IS 9779-1981. An acoustic check of the sound level measuring equipment and at least one band of the analysing equipment is made immediately before and after making the machine noise measurements. The sound level meter case and any measuring amplifiers or filters must be at least 0.3 m from the microphone, and the observer at least 1 m from the microphone, to prevent errors due to reflections from these objects. The calibration axis of the microphone should be pointed normal to the enveloping surface of the machine.

The next clause deals with measurement of sound radiation in a free field over a reflecting plane. The room suitability is established by placing a small broad-band noise source at the position to be occupied by the geometric centre of the machine to be tested and determining the mean sound level at the measurement positions and at corresponding positions at half their distance from the source. The difference between these mean sound pressure levels at full and half distance should be at least 5 dB for each frequency band employed.

The next two clauses determine the position of measurement points and method of measurement. The measurement points on each path should be at intervals of not more than 1 m from the five key measurement points. If measurements at these points indicate levels which exceed the mean level by more than 5 dB, additional points should be added midway between all the measurement points already in use. In some cases, the acoustic radiation pattern n of the machine requires the use of extra paths. The extra paths shall maintain the basic symmetry of the measurement points. At each measurement point the sound level in dB is measured.

The next three clauses determine the calculation of mean sound level, calculation of the radius of equivalent hemisphere and calculation of weighted sound power level.

The second test includes the detailed measurements based on frequency band analysis of sound radiation in a free field over a reflecting plane. The testing conditions, measuring instruments, method of measurement and location of measurement points are all like the first test. Octave and one-third octave band pass filters used for noise analysis shall comply with-IS: 6C6&1- 1973.

For the evaluation of test measurements in second test many tests are like the first one like Calculation of the Mean Sound Level, Calculation of the Radius of the Equivalent Hemisphere. It describes the measurement methods for new quantities such as Calculation of Octave Band Mean Sound Pressure Level, Evaluation of the Octave Band Mean Sound Power Levels, Evaluation of the Octave Band Mean Weighted Sound pressure levels, Evaluation of the Octave Band Mean Weighted Sound Power Levels and Evaluation of Acceptability Rating.

Results of the tests:

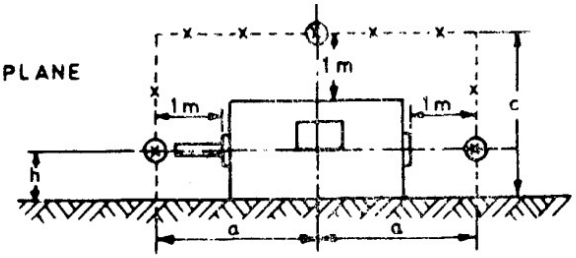
The next clauses define the framework for the presentation of the results in accordance with both method 1 and 2.

It then classifies the machine in terms of sound power emitted namely normal sound power, reduced sound power and especially low sound power.

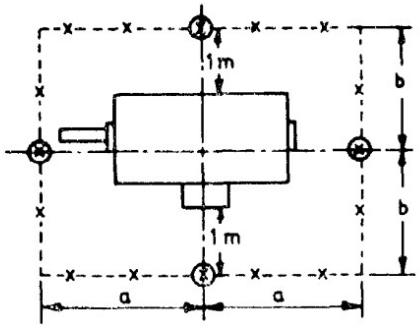
The standard now has appendix that gives examples of the tests conducted and special conditions for the measurement of the noise level. With Appendix A being the examples of the two method cases, Appendix B being the recommendations for assessing the noise of the machine on load, Appendix C being the test method for semi-reverberant conditions, Appendix D being a table of limiting mean sound power levels in db. for airborne noise emitted by rotating electrical machines and the last Appendix E being the conversion table.

The standard has defined and illustrated various methods for aligning the machines to horizontal, vertical and isometric plane for the described test methods of different machines: -

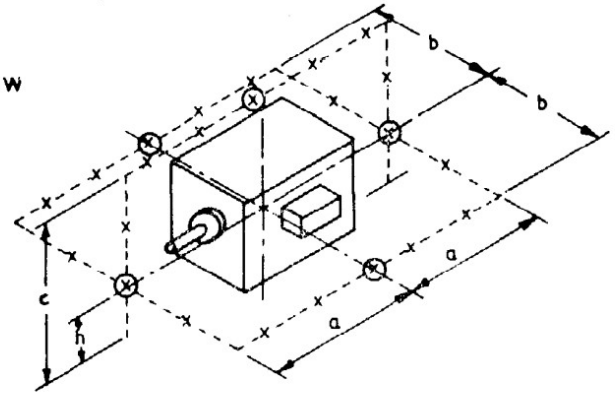
a) VERTICAL PLANE



b) HORIZONTAL PLANE



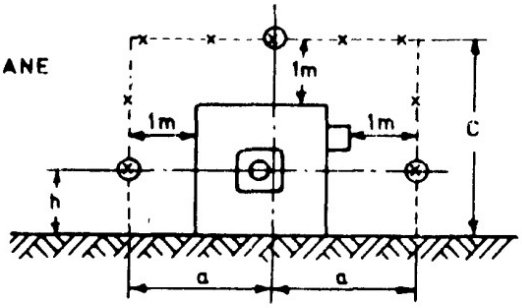
c) ISOMETRIC VIEW



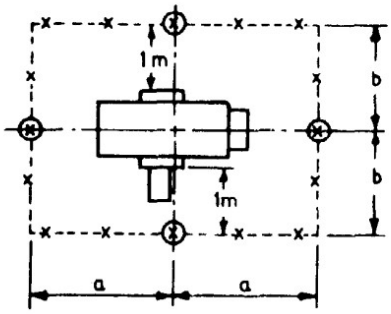
⊗ = Key measuring points.
× = Measuring points.

FIG. 2 LOCATION OF MEASURING POINTS AND PRESCRIBED PATHS FOR HORIZONTAL MACHINES WITH AXIAL LENGTH GREATER THAN OR EQUAL TO THE WIDTH

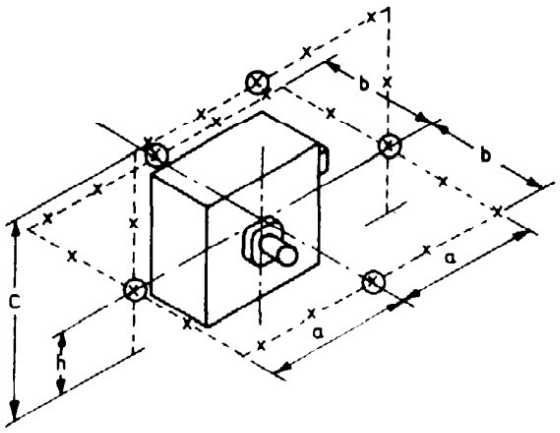
a) VERTICAL PLANE



b) HORIZONTAL PLANE

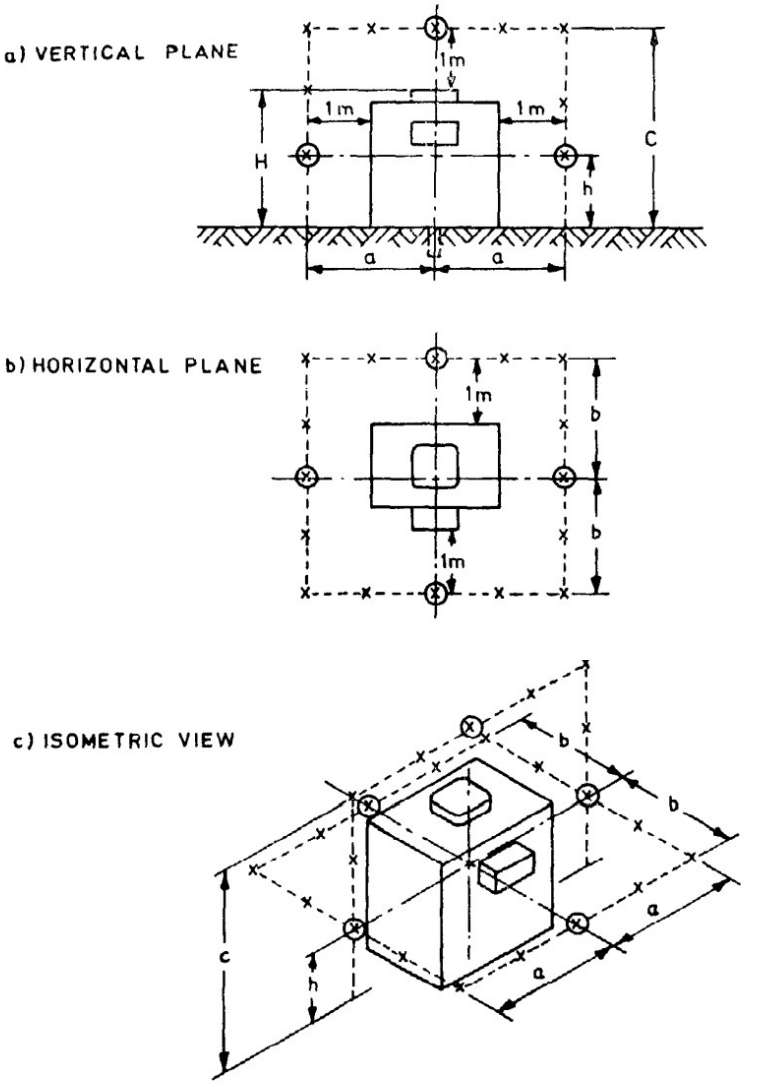


c) ISOMETRIC VIEW



⊗ = Key measuring points.
× = Measuring points.

FIG. 3 LOCATION OF MEASURING POINTS AND PRESCRIBED PATHS FOR HORIZONTAL MACHINES WITH AXIAL LENGTH SHORTER THAN THE WIDTH



NOTE — $h = \frac{H}{2}$ but not less than 0·25 m.

⊗ = Key measuring points.
× = Measuring points.

FIG. 4 LOCATION OF MEASURING POINTS AND PRESCRIBED PATHS FOR VERTICAL MACHINES

Conclusions:

The report presented summarizes and studies the various test methods described by the government standards for measurement of the noise of synchronous machines. We see the working, testing conditions and determine the exact conditions for the assessment of noise produced by different types of machines under different conditions.