Endurance wind power

Acoustic Data Application Note | E-Series S-Series



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SECTION 1—ACOUSTIC INFORMATION

Acoustic Data

Acoustic data is presented below for the Endurance Wind Power E-, G- and S-Series wind turbines. This data is based on the heights and distances provided in Table 1.

Table 1. Distances used in acoustic data report

Hub height [m (ft)]	31.0 (102)
Distance of rated sound, from nacelle [m (ft)]	60.0 (197)
Distance of rated sound, from tower base [m (ft)]	52.4 (172)
Height of observer [m (ft)]	1.80 (6)

Standard values are assumed for turbine height and observer height. The distance of rated sound from the nacelle is as specified in the American Wind Energy Association (AWEA) Small Wind Turbine Performance and Safety Standard, and describes the distance from the turbine to the observer. This distance along with hub and observer height is used to calculate the distance from the base of the turbine's tower to the observer.

Note that acoustic levels of the turbine and background noise both vary with wind speed. The data is presented for two different wind speeds: 5 and 10 m/s.

Table 2 contains acoustic data for the Endurance Wind Power E- and G-Series wind turbines. Table 3 contains equivalent data for the Endurance Wind Power S-Series wind turbines. Following this data is a detailed description of each value to help provide better insight into their meaning.

Rated Sound Levels

The highlighted cells in the above tables are the rated sound levels for each machine in compliance with the AWEA standard. As dictated by the standard, this is the maximum sound level 60 m (197 ft) from the turbine that will not be exceeded at least 95% of the time in a wind resource with a 5 m/s average wind speed. Such a wind resource would be less than 10 m/s almost exactly 95% of the time, so the 10 m/s values are used as the rated sound levels.

This standard way of specifying sound levels is an excellent method to communicate the sound level in a single value and allows for the meaningful comparison of different turbines. However, it does not provide meaningful information to the dealer or customer in terms of how audible the turbine is, how that sound is perceived relative to the environment and background noise, and how that sound changes with wind speed or distance to the turbine. It is these topics that the rest of the data presented in this document is intended to address.

Table 2. Acoustic attributes for the E- and G-Series turbines

Hub Height Wind Speed [m/s (mph)]	5 (11.2)	10 (22.4)
Acoustic Power Level, at turbine [dBA]	92.1	94.8
Acoustic Pressure Level, at rated distance [dBA]	45.4	48.1
Background Noise Level [dBA]	43.8	47.0
Distance at which turbine matches background [m (ft)]	66.8 (219)	61.9 (203)

Table 3. Acoustic attributes for the S-series turbines

Hub Height Wind Speed [m/s (mph)]	5 (11.2)	10 (22.4)
Acoustic Power Level, at turbine [dBA]	89.3	93.4
Acoustic Pressure Level, at rated distance [dBA]	42.6	46.7
Background Noise Level [dBA]	43.8	47.0
Distance at which turbine matches background [m (ft)]	43.3 (142)	50.0 (164)

Definition of Values

Each column of Table 2 and Table 3 on page 1-1 represents one wind speed scenario for the corresponding machine. Each column contains the following values:

- Acoustic Power Level (at turbine): This is the absolute power of the sound which is being produced at the wind turbine. This value defines how much sound a turbine produces, but it does not represent the impact this sound will have to a human ear, as the turbine is at the top of a tower some distance away, and the perceived sound decreases with distance. Also, background noise (including wind) will muffle the perceived sound of the turbine.
- Acoustic Pressure Level (at rated distance): This is the effective acoustic pressure at a reference point of 60 m from the base of the tower. This value indicates how loud the turbine will sound to a person standing at this distance, providing a better indication of the impact of the sound produced by the turbine.
- Wind Background Noise Level: This is the effective ambient acoustic pressure of the wind at the given wind speed. This value provides the baseline for environmental noise, independent from the sound generated by the turbine.
- Distance at which turbine matches background: This is the distance at which the (effective) acoustic pressure level of the turbine is equivalent to that of the wind.

Relative Sound Levels: Giving Numbers Some Perspective

Table 4 presents common sound levels in dBA in order to provide everyday context to the dBA values given above.

Table 4. Table of representative sound levels

Table of sound levels L (loudness) and corresponding sound pressure and sound intensity			
Sound Sources Examples with distance	**Sound Pressure Level L_p dBSPL**	**Sound Pressure p N/m^2 = Pa**	**Sound Intensity I W/m^2**
Jet aircraft, 50 m away	140	200	100
Threshold of pain	130	63.2	10
Threshold of discomfort	120	20	1
Chainsaw, 1 m distance	110	6.3	0.1
Disco, 1 m from speaker	100	2	0.01
Diesel truck, 10 m away	90	0.63	0.001
Kerbside of busy road, 5 m	80	0.2	0.0001
Vacuum cleaner, distance 1 m	70	0.063	0.00001
Conversational speech, 1 m	60	0.02	0.000001
Average home	50	0.0063	0.0000001
Quiet library	40	0.002	0.00000001
Quiet bedroom at night	30	0.00063	0.000000001
Background in TV studio	20	0.0002	0.0000000001
Rustling leaves in the distance	10	0.000063	0.00000000001
Threshold of hearing	0	0.00002	0.000000000001

From the data in Tables 2, 3 and 4, it can be seen that even during strong wind speeds of 10 m/s the Endurance turbines are on par with an average home. In the more frequent case of 5 m/s winds, the turbines are barely louder than a quiet library.

SECTION 2—PLOT INFORMATION

Plots: Sound as a Function of Distance

The following graphs show the sound level as a function of distance from the tower for each turbine. Graphs for wind speeds of 5 m/s are on the left, with 10 m/s wind speeds on the right.

E- and G-Series

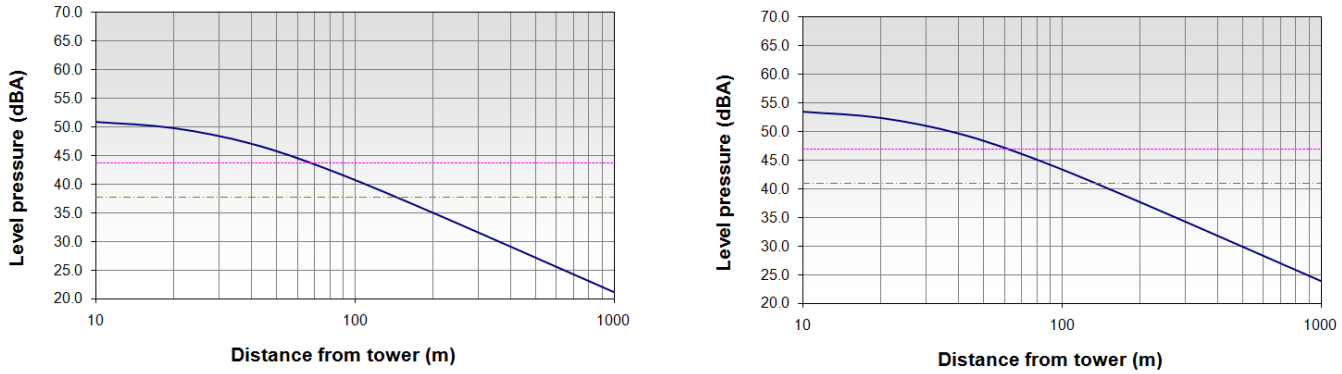


Figure 1. Sound level as a function of distance for the E- and G-Series turbines

S-Series

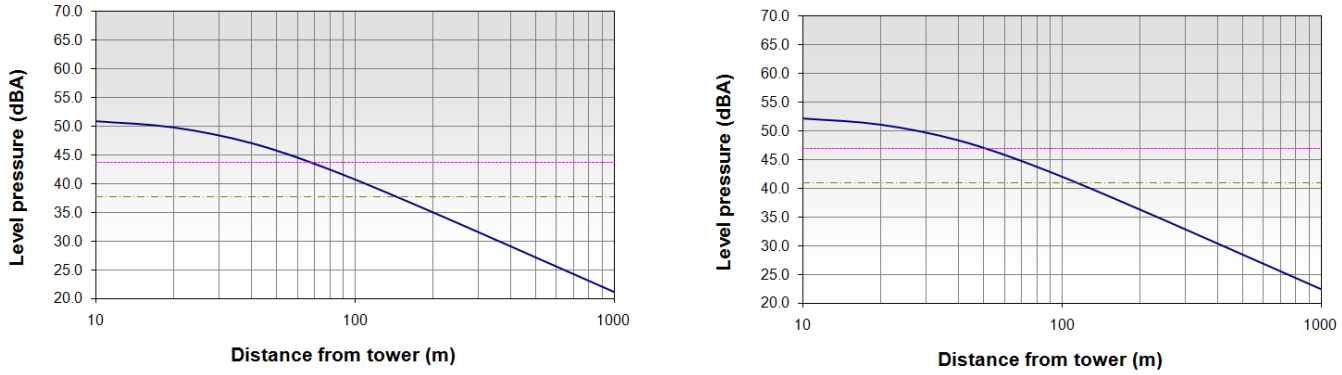


Figure 2. Sound level as a function of distance for the S-Series turbines

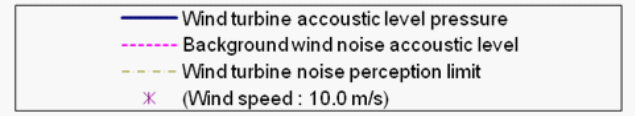


Figure 3. Graph legend for figures 1 and 2