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A COMPARATIVE STUDY OF SINGLE & DUAL-SCREEN WINDSHIELD DESIGN APPROACHES FOR NOISE MEASUREMENT IN HIGH WIND ENVIRONMENTS

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In recent years, the recommendation and use of a dual-screen design windshield for improved reduction of wind-induced microphone self-noise has become a topic of much discussion. While descriptions and examples of such apparatus can now be found in the standard working procedures documentation, such as IEC 64100-11, there remains no standardised form nor dimensions for this design concept of windshield, leading to various interpretations being now available from equipment manufacturers. In previous work, apparatus has been developed which utilises a spinning bar approach to wind testing, as opposed to low-noise wind tunnel facilities. This report presents the data acquired from the use of this equipment with a variety of dual-screen windshield designs. Discussion is also made regarding the issues, differences and validity of simulated outdoor wind environments of the experimental methods, plus the possible requirement for standardised methods of testing windscreens in laboratory and/or real-world conditions.

1 INTRODUCTION

1.1 Requirement for noise measurement in high wind

A fundamental factor in the proper measurement of noise is that it is carried out in low wind, preventing contamination of the intended noise source by noise from wind interaction upon the microphone system. The application of a small, open-cell foam, c. 80mm diameter spherical windshield centrally over the microphone is well-known to be effective to a point. Such windscreens have minimal attenuation, enough to be considered negligible, but are not effective in wind-noise reduction of even moderate winds; most standards thus stipulate 5m/s wind velocity to be the acceptable maximum.

There are some instances where noise measurement in high winds is unavoidable. Acoustic consultancies often need to determine the levels and cause of noise generated by wind interaction with buildings; a recent example being the Beetham tower in Manchester, UK, which is reported (Cox, 2013)[1] to have been measured at 78dBA at 100m. Projects such as this that require high-wind noise measurement are not commonplace, but are very much overshadowed in number by the main requirement for high-wind measurement; wind turbine noise. With installations of wind turbines in 2015 accounting for half of the total global electricity growth[2], this is a major and ever-increasing aspect of environmental noise measurement.

1.2 Physical mechanisms of wind noise

Wind noise was, up until the last few decades, considered to be mainly due to wake/vortex shedding in the flow past an object. Although it is recognised that this still is an aspect of the total, it has been shown (van den Burg 2005) [3] that another cause is the interaction of turbulence within the flow upon the solid body. Outdoors, it is considered (Morgan & Raspet 1992) [4] that the highly turbulent nature of the flow is usually the dominant contribution to the noise caused by the flow interaction with the microphone. As summarised by Walker and Hedlin (2010)[5], from Raspet (2006)[6] and Shields (2005)[7], the stagnation pressure; the pressure at the point in space in front of a body within a fluid flow is a combination of the absolute atmospheric pressure combined with any effects of the fluid flow. As the wind is deflected by the body, kinetic energy is converted into pressure potential energy. Thus, turbulence; fluctuations in the mean velocity; will cause variation of the stagnation pressure which will contribute to any intended-measured acoustic pressure.