Review of Test Procedures for the Characterisation of the Acoustics Properties of Alternative Ventilation Ducts

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About the research

To date there is no information on the acoustic characteristics of alternative materials ventilation ducts to enable accurate prediction of duct borne noise levels. The absence of accurate information leads to crude estimations or calculations based on galvanized ducting data.

The lack of suitable acoustic test procedure for ventilation ducts has also been noted within the standardised methods and procedures.

This research is set up to close that gap, to define suitable testing procedure of the ventilation ducts and to determine acoustic characteristics of plastic and other alternative ventilation ducts for the development of prediction models and guidance in practical installations.

About this stage

This poster reviews testing procedures and their suitability for the characterisation of the acoustic properties of plastic and alternative ventilation ducts.

The aim of this stage of the development is to survey known test procedures found in the literature and those used by the industry and other practitioners. This will enable the analysis and scrutiny of best practice to inform the creation of robust and industry accepted test procedure.

Fig 1. Typical ventilation plastic ductwork installation showing bends and connections

Fig 2. Typical plastic duct T-Branch

Testing Methods Literature Review

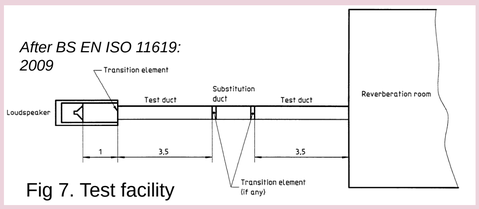


Fig 7. Test facility

After *BS EN ISO 11619: 2009*

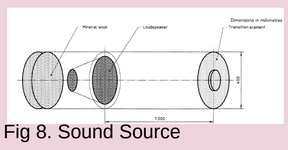


Fig 8. Sound Source

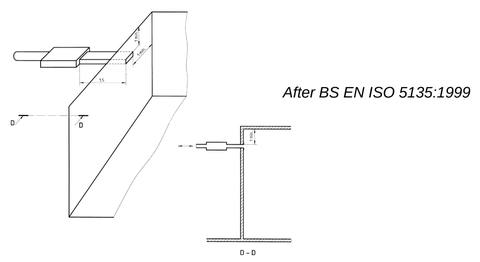
BS EN ISO 11691: 2009

A laboratory substitution method to determine the insertion loss without the flow of ducted silencers.

STRENGTH: standardised method, measuring transmission loss
WEAKNESS: restricted suitability, no guidance for measurement of regenerative sound power levels, breakout or break in
TESTING FACILITY: large specific testing facility required

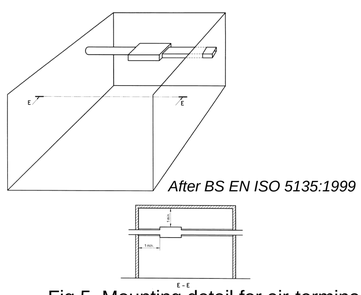
BS EN ISO 5135:1999

Determination of sound power levels from ventilation system elements by measurements in a reverberation room.



After BS EN ISO 5135:1999

Fig 4. Mounting detail for air-terminal units installed outside room boundary



After BS EN ISO 5135:1999

Fig 5. Mounting detail for air-terminal unit to determine casing radiated sound

STRENGTH: limited application for determination of break out and break in noise
WEAKNESS: no guidance for transmission loss or regenerative sound power levels
TESTING FACILITY: large and specific testing facility required

BS ISO 13347-4:2004

Determination of fan sound power levels in the standardized laboratory conditions using Sound Intensity Method

STRENGTH: quick, effective for breakout and potentially break in, no special testing facility required
WEAKNESS: uncertainty regarding transmission losses, not used in the past for this purpose
TESTING FACILITY: no specific testing facility required, in situ measurements

Fig 6. Demonstration of Sound Intensity used for measuring fan's sound power levels, image courtesy of Bruel & Kaejer

BS EN ISO 7235: 2009

Determination of insertion losses of ducted silencers with and without airflow as well as regenerative sound power levels due to air flow.

STRENGTH: standardised method, measuring transmission loss and regenerative sound power level
WEAKNESS: partially suitable, no guidance for testing for breakout, break in and bend measurements, 2m max. length of the test piece
TESTING FACILITY: specific and complex test rig required for the tests with air flow

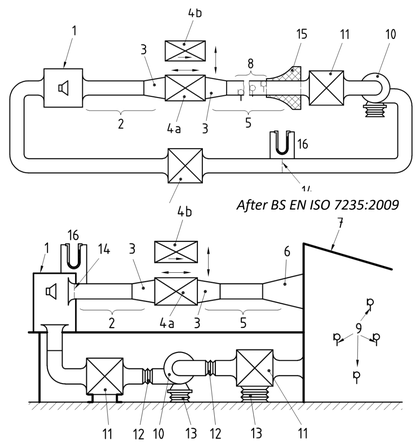


Fig 3. Examples of arrangements of the test facility for measurements of insertion loss with airflow and/or flow noise

ASTM – E477: 1999

Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers using substitution method

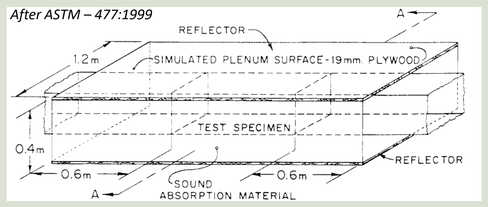


Fig 9. Simulated Semi-Reflective Plenum Configuration

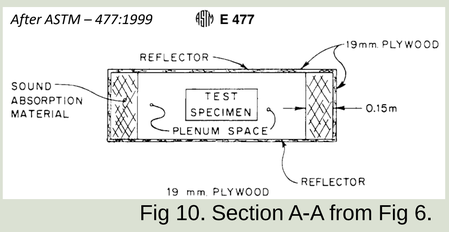


Fig 10. Section A-A from Fig 6.

STRENGTH: measurement of insertion losses and regenerative sound power levels
WEAKNESS: not used in the UK, no guidance for breakout and break in
TESTING FACILITY: large specific testing facility required

Industry wide consultation

An industry UK wide consultation has been set up to gather views from practitioners on the development of robust, practical and industry-accepted novel test procedures. The consultation so far has revealed:

- Possibility of testing in real world installations
- Regenerative noise check for higher air velocities
- Need to investigate breakout noise homogeneity along the length
- Explore other non-standardised and not widely known customised tests

Conclusion

- There is no specific and suited tests methodology for the intended purpose
- Tests procedures available are not well harmonised
- There is a need to create an industry accepted test procedure
- Testing in real world installations option

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