REPORT ON AN INVESTIGATION INTO THE FIELD PERFORMANCE OF THE OASIS ATMOS TEAM POD AIR ACOUSTIC OFFICE POD

PREPARED ON THE INSTRUCTIONS OF
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C O N T E N T S

1. INTRODUCTION

1.1 Hawkins and Associates Limited ('Hawkins') has been engaged by Frem Group Screens Limited ('Frem') to provide a measurement of the acoustic performance of the Oasis Atmos Team Pod Air acoustic office pod.

1.2 The Oasis Atmos Team Pod Air is a single or multiple occupancy office pod, with a glazed back and front and a sealed glazed door in the front. The sides of the pod are fabric-clad Medium-density Fibreboard (MDF) with acoustic foam lining to their inner faces. The ceiling is formed from fabric clad MDF, with a Polyethylene terephthalate (PET) lining to its interior face. A ceiling light and air extraction fan are installed in the ceiling. The intended use of the pod is as a private space for telephone calls, focussed work, or meetings in open plan office environments.

1.3 There are several acoustic pods available for purchase in the British furniture industry, each publishing an acoustic 'rating'. However, until 2020, there existed no formal National or International Standard for assessing the performance of an acoustic pod.

1.4 Many pod manufacturers rely only on the laboratory tested airborne sound insulation performance of certain elements of their pods, for example, the performance of a single wall or door, to demonstrate the acoustic performance of their pods. However, due to the inherent acoustical weaknesses in such systems due to fan penetrations, door seals and other weak junctions, the laboratory performance of single elements does not reflect the performance of the pod when fully constructed.

1.5 Another method by which pods are tested is the modified use of BS EN ISO 16283-1:2014, '*Acoustics - Field measurement of sound insulation in buildings and of building elements. Airborne sound insulation*'. The method must normally

be modified as, due to the size of smaller, single-person pods, and therefore the limited number and spacing of microphone and loudspeaker positions, as well as the general direction of testing (with the noise source inside the pod), field testing of an acoustic pod cannot be carried out in full compliance with this Standard.

1.6 In 2020, an International and British Standard, BS ISO 23351-1 '*Acoustics – Measurement of speech level reduction of furniture ensembles and enclosures – Part 1: Laboratory method*' became available. The method involves carrying out an assessment of the difference in the sound power of a sound source alone and that when it is placed inside a pod. The test must be carried out within a specialised acoustic laboratory called a reverberation chamber. There are several problems with implementing this method in the assessment of acoustic pods, the most significant of which are:

i. The size of the acoustic laboratories in the United Kingdom significantly limits the size of the pods that can be tested;
ii. Due to the highly reverberant nature of the reverberation chamber, the results of the testing do not reflect a 'real-world' performance of the pod, mainly in open plan offices;
iii. In general, salespeople and consumers are unqualified to distinguish between those manufacturers who have tested their pods according to the new Standard and those who have conducted their testing to an alternative or modified Standard. If only some manufacturers test their pods according to this new Standard, the results will likely appear poorer than those that have qualified their pods using alternative methods.

1.7 The Finishes and Interiors Sector ('the FIS') has proposed a verification scheme for acoustic pods. At the time of writing this report, the FIS are, in conjunction with a professional 'working group', considering a way in which acoustic pods can

be tested and verified. However, the verification method, which has yet to be finalised, could result in the same limitations discussed in 1.5ii and 1.5iii, above.

1.8 Hawkins has, therefore, conducted acoustic testing of the Oasis Atmos Team Pod Air based on various methods which might be useful to the manufacturer and users of the pod. These assessments are not necessarily defined in any formal Standard but are thought to provide useful data to Frem and specifiers until the FIS verification scheme is formally introduced. The results are not intended to replicate testing in accordance with BS ISO 23351-1.

1.9 A Glossary of Terms can be found in **Appendix A**. The design and dimensions of the pod tested can be found in **Appendix B**. A list of guidance documents and Standards that have been used to inform this assessment include:

- BS 8233:2014, *'Guidance on Sound Insulation and Noise Reduction in Buildings'*
- BS EN ISO 3382-2:2008, *'Acoustics - Measurement of Room Acoustic Parameters – Part 2: Reverberation time in ordinary rooms'*
- BS EN ISO 3382-3, *'Acoustics – Measurement of room acoustic parameters – Part 3: Open plan offices'*
- BS EN ISO 16283-1:2014, *'Acoustics - Field measurement of sound insulation in buildings and of building elements . Airborne sound insulation'*
- BS EN ISO 717-1:2013, *'Acoustics - Rating of sound insulation in buildings and of building elements. Airborne sound insulation'*
- Finishes and Interiors Sector (2015). *'A guide to office acoustics'*
- BS ISO 23351-1:2020, *'Acoustics – Measurement of speech level reduction of furniture ensembles and enclosures – Part 1: Laboratory method'*

2. GENERAL ACOUSTICS CRITERIA FOR OFFICES

2.1 Indoor Ambient Noise Levels

2.1.1 Indoor ambient noise levels for commercial buildings are addressed in BS 8233, '*Guidance on Sound Insulation and Noise Reduction in Buildings*'. **Table 1**, below, gives a summary of the salient information from Tables 2 and 6 of BS 8233. It should be noted that the design range gives both a maximum and a minimum value for indoor ambient noise in unoccupied spaces where privacy is important.

Table 1: Extract from BS 8233 – Indoor ambient noise levels in office spaces

Objective	Typical Situations	Design Range $L_{Aeq,T}$ dB
Typical noise levels for acoustic privacy in shared spaces	Open Plan Office	45-50
Typical noise levels for study and work requiring concentration	Meeting / Training Room Executive Office	35-45 35-40

2.1.2 These noise levels generally apply to steady sources, such as mechanical services and traffic noise, and are the noise levels achieved in the space during normal hours of occupation. Noise produced by the occupants and their activities is excluded from these design levels. If noise levels drop below these values, acoustic privacy may be compromised.

2.2 Sound Insulation

2.2.1 In addition to controlling the level of ambient noise, it is necessary to control noise transmitted between adjacent spaces according to the noise levels likely to be produced, noise sensitivity and privacy requirements. A matrix is given in BS 8233, showing sound insulation requirements for partitions separating rooms with different privacy needs. While there is no such matrix relating to acoustic pods, the guidance relating to partition performance is useful when considering an

enclosure, such as a pod, which is to be used as a private space. This matrix is summarised in **Table 2** of this report. Manufacturers' rating values for pods are often given for partitions in the form of 'Weighted Sound Reduction Index' (R_w) values rather than the 'Weighted Standardized Level Difference' ($D_{nT,w}$) values given in Table 2. R_w is a laboratory test value and, typically, installed partitions fail to perform to this level due to flanking paths and installation limitations.

Table 2: Extract from BS 8233 – On-Site Sound Insulation Matrix (dB $D_{nT,w}$)

Privacy Requirement	Activity noise of Source Room	Noise Sensitivity of Receiving Rooms		
		Low Sensitivity	Medium Sensitivity	Sensitive
Confidential	Very High	47	52	57*
	High	47	47	52
	Typical	47	47	47
	Low	42	42	47
Moderate	Very High	47	52	57*
	High	37	42	47
	Typical	37	37	42
	Low	No Rating	No Rating	37
Not Private	Very High	47	52	57*
	High	37	42	47
	Typical	No Rating	37	42
	Low	No Rating	No Rating	37
Note: These values assume adequate levels of ambient noise present in the spaces. If ambient noise levels fall below recommended levels, it is possible that privacy will be affected.				

2.2.2 While the field performance of partition systems is generally given as $D_{nT,w}$, this is to allow for the variation in the amount of absorption within the receiver area. The nature of the acoustics in open-plan offices (in which acoustic pods are normally installed) is such that the reverberation time within those with good acoustic environments, is normally lower than the value used for standardisation. Therefore, standardising the performance to a given, higher, reverberation time will give unrepresentative results. It is therefore thought that the Weighted Level Difference (D_w) is a more appropriate measure for the sound insulation performance of these acoustic pods. It is important to note, however, that the environment in which a pod is tested will not normally reflect that of an open plan

office. However, in the event that an acoustic pod is tested in an area in which reverberation times exceed those of an open plan office environment, it is more appropriate to use $D_{nT,w}$ to approximate its performance in the 'real world'.

2.3 Speech Level Difference

2.3.1 There is currently no formal guidance for speech level reduction between different areas in offices.

3. TEST ENVIRONMENT, AND MEASUREMENT EQUIPMENT

3.1 Test Environment

a) Setting

3.1.1 The test pod was installed in a carpeted area of the Frem factory in Haverhill. The nearest reflective surface, other than the floor, was some racking, located over 5 metres from the left-hand side of the pod. All other surfaces were over 10 metres from the pod. Measurements taken at 2 and 3 metres from the pod were unlikely, therefore, to have been significantly affected by reflections. A photograph showing the test environment is provided in **Photograph 1**.

Photograph 1: The pod in the test area

b) Ambient Noise Levels

3.1.2 Both the pod fan and lighting are activated by a PIR system in the pod. It is, therefore, expected that the ambient noise levels inside the pod, when it is in use,

include the noise from the fan. The measured ambient noise levels both inside and outside the pod were as follows:

i. Inside pod with fan activated - 40 dBA;
ii. Outside the pod - 47 dBA.

c) Reverberation

3.1.3 Reverberation time within the test area was measured in general accordance with BS EN ISO 3382-2:2008 '*Acoustics. Measurement of room acoustic parameters. Reverberation time in ordinary rooms*'. The mid-frequency reverberation time was found to be 1.2 seconds. This is significantly higher than would be expected in an open plan office with good acoustics. Typically, a reverberation time of less than 0.5 seconds is recommended for open plan offices. Reverberation time data were used in the calculation of the Weighted Standardised Level Difference.

3.2 Measurement Equipment

3.2.1 The following instrumentation was used in order to assess the pod:

i. Norsonic Type 118 IEC 60651 Type 1 Sound Level Meter (serial no. 28953)
ii. Bruel & Kjaer 4230 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 558650)
iii. Norsonic Nor 280 Power Amplifier (serial no. 2803704)
iv. Norsonic Nor 276 Dodecahedron Loudspeaker (serial no. 2766162)

3.2.2 Before and after the measurements the Norsonic Type 118 was field calibrated using the Bruel & Kjaer 4230 Sound Calibrator. No calibration shift was noted. All equipment is calibrated in accordance with an approved calibration programme.

4. MEASUREMENT RESULTS AND POD PERFORMANCE

4.1 Preamble

4.1.1 All assessments assume the door to the pod will be closed when in use. Where 'receiver' measurements were made external to the pods, these were made at distances of 1, 2, and 3 metres from the walls of the pod.

4.2 Weighted Standardised Level Difference, $D_{nT,w}$ (In to Out)

4.2.1 Due to the size of the pod, both the tester and microphone, during measurement of the 'source' level inside the pod, were within 1 metre of the loudspeaker, and therefore this test methodology does not comply with BS EN ISO 16283-1:2014. The level difference, D, data were used to calculated $D_{nT,w}$ in accordance with BS EN ISO 717-1. The following assessment of sound insulation performance should, therefore, be considered indicative only.

4.2.2 The sound source was excited in the pod with pink noise at 1 metre above finished floor height. As the reverberation time within the test space was significantly higher than would be expected of an open plan office with a good acoustic environment, the Weighted Standardised Level Difference, $D_{nT,w}$, rather than Weighted Level Difference, D_w, has been calculated to 'correct' for the higher reverberation time. The results are summarised in **Table 3**.

Table 3: Weighted Standardised Level Difference ($D_{nT,w}$) Results – Door Closed

Side	Calculated Weighted Standardised Level Difference $D_{nT,w}$ (dB)		
	1 m	2 m	3 m
Front	38	40	42
Right	38	41	43
Back	40	42	43
Left	38	41	43

4.3 Speech Level Reduction $D_{S,A}$

4.3.1 The sound source was excited with the pod removed. Measurements of the sound pressure level in the test area were then taken at 1, 2, and 3 metres away from where the walls of the pod were, to compare the noise levels in the test space resulting from the loudspeaker inside the pod, versus the loudspeaker not inside a pod.

4.3.2 Where possible, the measurements were generally conducted following the methods specified in BS ISO 23351-1:2020, '*Acoustics — Measurement of speech level reduction of furniture ensembles and enclosures — Part 1: Laboratory method'*. It should be noted that the testing was not undertaken in a reverberation room meeting the specifications of the standard, and measurements of the sound level in the test room were taken at set distances from each side of the pod, rather than at random locations around the room. Therefore, the results are not necessarily comparable with those generated in a laboratory setting.

4.3.3 The results of the average level reduction and average speech level reduction for each side of the pod, as specified in BS ISO 23351, are summarised in **Table 4**.

Table 4: Results of level reduction for each side of the pod

f [Hz]	Level Reduction D_i [dB]				
	Front	**Left**	**Back**	**Right**	**Average**
125	30.2	28.0	26.9	28.5	28.5
250	28.0	22.9	26.8	23.5	25.8
500	34.1	32.3	33.5	32.8	33.2
1000	40.8	42.2	42.4	42.2	41.9
2000	42.0	47.1	47.5	47.1	46.4
4000	41.8	47.7	51.6	47.4	48.4
8000	39.4	44.6	45.6	43.1	43.7
$D_{S,A}$ [dB]	34.3	31.6	33.5	32.0	32.8

4.3.4 The calculated speech level reduction values resulting from the measured level reduction, are provided for each side of the pod, at each distance measured, in **Table 5**.

Table 5: Results of speech level reduction for each side of the pod, at the various distances measured on each side.

Side	Speech Level Reduction $D_{S,A}$ (dB)		
	1 m	**2 m**	**3 m**
Front	34	34	34
Right	31	32	33
Back	35	32	34
Left	31	31	32

4.3.5 As the measurements were not made in full accordance with the test standard, the accuracy of the reported speech level reduction performance values cannot be verified and are likely to be significantly overestimated.

5. CONCLUSIONS

5.1 The acoustic pod, Oasis Atmos Team Pod Air, by Frem, has been assessed for its airborne sound insulation and speech level reduction performance. The four sides of the pod were assessed separately at various distances from the pod wall.

5.2 There is currently no formal way by which to assess the acoustic performance of a pod in the field, and the accepted laboratory-based assessment method is significantly limited. Therefore, a modified test method has been used to provide an indicative performance of the Oasis Atmos Team Pod Air.

5.3 The results of this assessment show that the pod achieves airborne sound insulation performance values between $D_{nT,w}$ 38 and 43 dB, and speech level reduction performance values between $D_{S,A}$ 31 and 34 dB, depending on the side of the pod assessed and the distance from the pod. Note, neither assessment was conducted in full accordance with the test standard due to limitation in the test and sample space and the results are likely to overestimate the true performance of the pod.

APPENDIX A

Glossary of Terms

Appendix A

Glossary Of Terms

Term	Symbol	Description
Equivalent continuous A-weighted sound pressure level	$L_{Aeq,T}$	The value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, *T*, has the same mean-squared sound pressure as the sound under consideration that varies with time
Indoor ambient noise	-	The noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Octave band	-	A band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Reverberation time	***T***	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound level difference	***D***	The difference between the sound pressure level in a source area and the resulting sound pressure level in a receiving area
Sound reduction index	***R***	A laboratory measure of the sound insulating properties of a material or building element in a stated frequency band
Weighted sound reduction index	R_w	A single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies *NOTE The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory*
Standardized level difference	D_{nT}	The difference in sound level between a pair of spaces, in a stated frequency band, normalized to a reference reverberation time of 0.5 s for dwellings
Weighted level difference	D_w	A single-number quantity that characterizes airborne sound insulation between spaces, but which is not adjusted to reference conditions
Weighted standardized level difference	$D_{nT,w}$	A single-number quantity that characterizes the airborne sound insulation between spaces *NOTE Weighted standardized level difference is used to characterize the insulation between rooms in a building*
Speech Level Reduction	$D_{S,A}$	The reduction of A-weighted sound power level of speech caused by a test sample

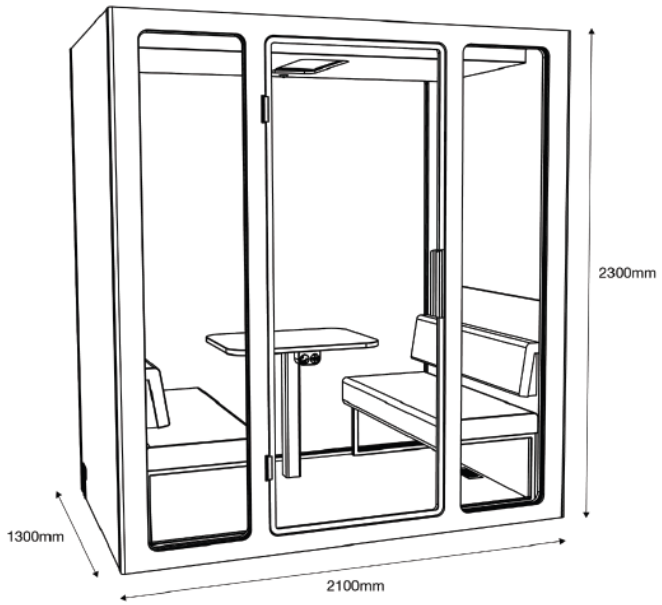
APPENDIX B

Pod Design and Dimensions

Appendix B

Pod Design and Dimensions

Dimensions



Exterior

Height 2300mm

Width 2100mm

Depth 1300mm

Interior

Height 2080mm

Width 1872mm

Depth 1192mm

Doorway

Width 817mm