

# ACOUSTICS VENTILATION & OVERHEATING GUIDANCE

## AVOG

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MAX FORDHAM

# THE PROBLEM

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- Ventilation is required to achieve good air quality and to mitigate overheating.
- But ventilation can result in **unacceptably** high indoor ambient noise levels.
- Buildings that don't work.
- This has become an increasing problem as buildings become better insulated and more airtight.

# AVOG - AIMS

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- Help acousticians understand ventilation and overheating.
- Set out desirable indoor ambient noise levels.
- Provide quantitative, usable guidance – for designers, planners, pre-completion testing.
- Give worked examples/case-studies.

# AVOG - WORKING GROUP

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# AVOG - CONTENTS

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- Section 1 - Introduction
- Section 2- Relevant legislation and guidance
  - 2.1 Ventilation
  - 2.2 Overheating
  - 2.3 Acoustics
- Section 3 – Internal ambient noise level guidelines
  - 3.1 Transport noise sources
  - 3.2 Mechanical services noise
- Section 4 – Worked example

## AVOG - SCOPE

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- New residential development that will be exposed predominantly to airborne sound from transport sources, and to sound from mechanical services that are serving the dwelling.

# NOISE FROM TRANSPORT SOURCES

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- Two distinct situations
  - Part F ventilation condition
  - Overheating condition

# PART F VENTILATION CONDITION

Ventilation condition	Possible system or design solution	Desirable internal ambient noise level from transport noise sources
Part F - Whole dwelling ventilation	<p>System 1: Intermittent extract fans with background ('trickle') ventilators <sup>[2]</sup></p> <p>System 2: Passive stack ventilators with background ('trickle') ventilators <sup>[2]</sup></p> <p>System 3: Continuous mechanical extract with background ('trickle') ventilators <sup>[2]</sup></p> <p>System 4: Continuous mechanical supply and extract with heat recovery (MVHR)</p>	Guideline values from Table 4 of BS 8233:2014.
Part F – Purge Ventilation <sup>[1]</sup>	<p>Option 1: Opening external window(s) meeting requirements described in Appendix B of Part F.</p> <p>Option 2: Manually controlled fan extracting 4 air changes per hour.</p>	<p>No specific acoustic criterion needs to be met.</p> <p>Consider criteria above for adjacent rooms in the same dwelling.</p>



## OVERHEATING CONDITION

- What is an appropriate indoor ambient noise level?
- What about BS8233 values?
- Would imply mechanical cooling (air-con) on sites with  $L_{day} > 60\text{dB}$ ,  $L_{night} > 55\text{dB}$ . Not sustainable.
- Reasonable to allow higher levels for overheating condition on the basis that it occurs for only part of the time and occupants may accept a trade-off between acoustic and thermal conditions given that they have some control over their environment.
- No specific research available – combined exposure to heat & noise

# **OVERHEATING CONDITION – BASIS OF GUIDANCE**

- The acceptability of higher internal ambient noise levels has been considered in terms of various effects such as:
  - Daytime annoyance
  - Daytime interference with activities (conversations, watching tv, telephone)
  - Night-time sleep disturbance

# OVERHEATING CONDITION – DAYTIME

Source	Effect	External Free-field Noise Level (LAeq,16hr)													
		50	52	54	56	58	60	62	64	66	68	70			

Assume D = 12dB for a partially open window







# OVERHEATING CONDITION – DAYTIME

		External Free-field Noise Level (LAeq,16hr)											
Source	Effect	50	52	54	56	58	60	62	64	66	68	70	
BS8233 (2014)	Reasonable conditions												
Noise Insulation Regs	Trigger for grant - Road												
Noise Insulation Regs	Trigger for grant - Rail												
Noise Insulation Regs	Trigger for grant - Air												
Aviation Policy Framework	Eligibility for sound insulation												
WHO (1999)	Speech - 'understood fairly well'												
WHO (1999)	Speech - 'raised voice'												
BS8233 (2014)	Speech - 'raised voice at 2m'												
Wilson (1963)	Speech - 'tolerable'									*			
AVOG	Risk Category	LOW			MEDIUM					HIGH			













# OVERHEATING CONDITION – NIGHT-TIME AVERAGE

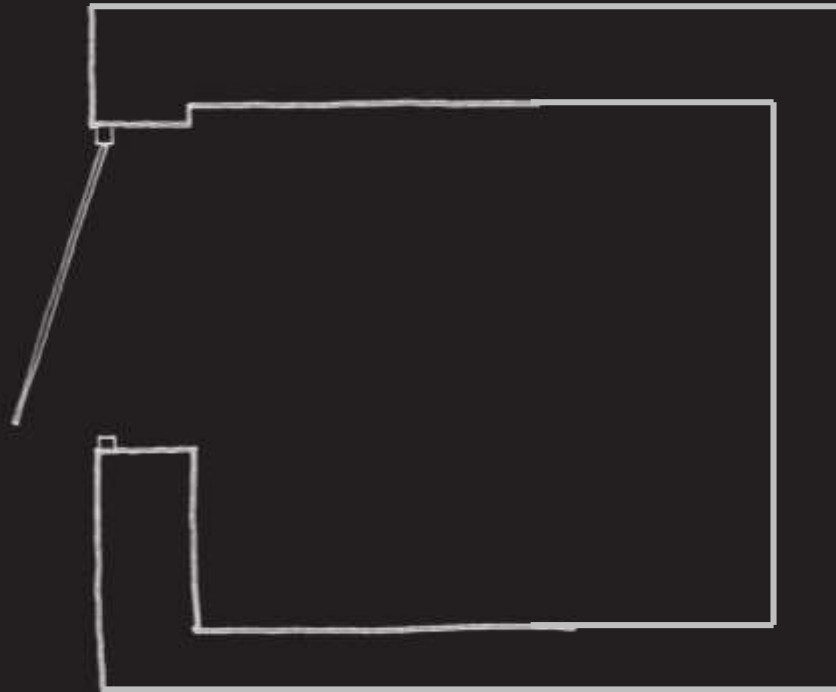
		External Free-field Noise Level (LAeq,8hr)											
Source	Effect	40	42	44	46	48	50	52	54	56	58	60	
BS8233 (2014)	Reasonable conditions												
PPG24 (2006 - withdrawn)	Cat C threshold - road, air, mixed												
PPG24 (2006 - withdrawn)	Cat C threshold - rail												
WHO NNG (2014)	LOAEL												
WHO NNG (2014)	Health effects - 'Interim target'												
Schutz gegen Fluglärm	Threshold for mitigation												
Stanstead	Threshold for mitigation												
Nottinham East Midlands	Threshold for mitigation												
AVOG	Risk Category	LOW				MEDIUM				HIGH			

# OVERHEATING CONDITION – 2 LEVEL ASSESSMENT

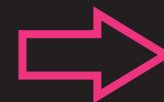
Level 1

Level 2

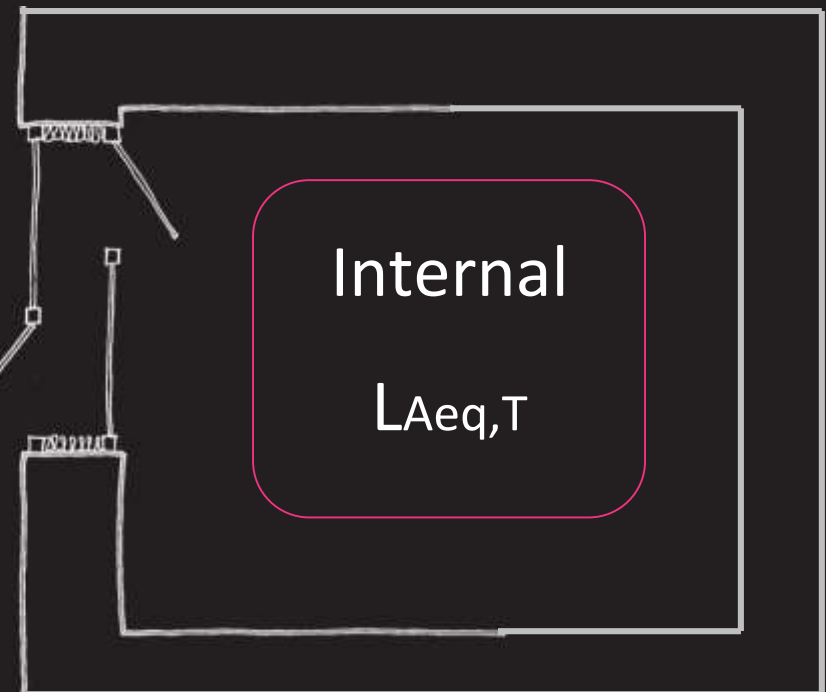
External  
Free-field  
 $L_{Aeq,T}$



$D \approx 12\text{dB}$



Internal  
 $L_{Aeq,T}$



$D > 12\text{dB}$

# NOISE FROM MECHANICAL SERVICES

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- Substantial research demonstrates that if noise from mechanical ventilation is considered excessive by the occupants, where they have control they will turn down the system to a level of noise that is tolerable, or disable it entirely.
- Either of these actions result in insufficient ventilation.
- Two distinct situations
  - Part F ventilation condition
  - Overheating condition

# SUMMARY OF EXISTING GUIDANCE

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Room Type	Approved Document F $L_{Aeq,T}$ (dB)	CIBSE Guide A Table 1.5 $L_{Aeq,T}$ (dB)	Sound control for homes – BRE/CIRIA $L_{Aeq,T}$ (dB)
Bedroom	30	30	30
Living Room	30	35	35
Dining Room	-	-	35
Bathroom / WC	-	-	45
Kitchen	-	45-50	45



# PART F VENTILATION CONDITION

Ventilation Condition	Possible system or design solution	Source for desirable internal ambient noise levels from mechanical services
Part F – Whole Dwelling Ventilation	<p>System 3: Continuous mechanical extract (MEV), minimum low ventilation rates</p> <p>System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum low ventilation rates</p>	Approved Document F
Part F – Extract Ventilation	<p>System 1: Intermittent extract fans</p> <p>System 3: Continuous mechanical extract (MEV), minimum high ventilation rates</p> <p>System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum high ventilation rates</p>	<p>Comfort criteria from CIBSE Guide A, Table 1.5</p> <p>or</p> <p>Sound control for homes – BRE / CIRIA</p>
Part F – Purge Ventilation	Manually controlled fan exchanging a minimum 4 air changes per hour	<p>No desirable noise levels are currently proposed based on the lack of evidence of acceptable noise levels</p> <p>Consider criteria above for adjacent rooms in the same dwelling</p>

# OVERHEATING CONDITION

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Possible system or design solution	Source for desirable internal ambient noise levels from mechanical services
Mechanical ventilation introducing ambient air	Comfort criteria from CIBSE Guide A Table 1.5
Mechanical system introducing cooled air	or Sound control for homes – BRE / CIRIA

- The levels shown in the table are based on systems which are operated to meet the design conditions to control overheating.
- Higher noise levels may be acceptable for ‘boost mode’.

# PROGRAMME FOR PUBLICATION

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- Worked Example / Case Studies being finalised.
- Time allowed for review by a small selected panel.
- Release draft to ANC members before the end of the year.

## FUTURE WORK

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- Research study of the human response to, and inter-dependence of, acoustic and thermal comfort in dwellings.

**THANK YOU**

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