RESIDENTIAL AC NOISE ISSUES

Residential air conditioning noise issues are a common complaint or query – with people often demanding to know who is responsible, what are the penalties, and exactly how much noise, at what time, is acceptable.

In this two-part Skills Workshop, we will explore residential noise in general, as well as how it is regulated and enforced in specific states and territories.

INDOOR NOISE

Indoor units contain a fan for moving room air over the heat exchange coil and distributing it throughout the room being served. Fans can generate noise, as can turbulent airflows. Modern air conditioners are generally designed for quiet operation, but indoor noise can be an issue if an air conditioning unit is oversized for the room or zone, or is installed in an inappropriate location.

Ducted systems also have particular noise considerations. Fan noise can be transmitted down the duct, noise can be generated at dampers and air control devices. Also, particularly when systems are not operating, there is the potential for noise generated within one zone or room to be transmitted through the duct to another room. This may be an issue when family or entertainment rooms and bedrooms are served by a common ducted system. Proper duct design, unit selection and the addition of noise attenuators to ductwork systems can all help solve indoor noise issue.

However, this Skills Workshop will focus largely on outdoor noise.

OUTDOOR NOISE

Air conditioner noise complaints made to local councils, the police and other government authorities have greatly increased over the past few years. This may be because of increased high density living, and less space between homes, as well as a general increase in the installation of air conditioning in the residential areas. Additionally, poor or inappropriate installation practices, and a poor understanding of environmental noise issues, can also contribute.

Homeowners often aren't aware that their noisy air conditioner is impacting neighbours, or that by exceeding noise levels they may be breaking the law and could be penalised. However, by raising people's awareness of noise nuisances and the potential penalties, these nuisances may be reduced.

Limited advice from retailers and installers, and a lack of forethought and planning by owners, retailers and installers on the location and use of air conditioners also contributes to noise issues. Manufacturers, installers and retailers should provide responsible advice and service at the beginning and throughout the air conditioning selection and installation process to prevent noise nuisance.

Any air conditioning manufacturer, supplier or installer claiming compliance with these guidelines should know the sound power level of the unit, and be able to determine whether a unit/location combination is compliant with local noise regulations.

ENVIRONMENTAL NOISE

Noise by definition is sound that is unwanted or unpleasant in some way.

When environmental noise reaches elevated levels in our living spaces, it can have significant impacts on our health and wellbeing by disturbing sleep and interfering with relaxation and communication. Noise can also affect our performance, learning and stress levels.

The level of annoyance experienced from the noise depends on the level of the noise, type of noise, how often it occurs, how long it goes for, time of day or night and the individual's own tolerance.

Noise annoyance can result in changes in behaviour, such as closing windows, not using balconies and turning up the television volume. In some cases annoyance can be extreme and can lead to aggression.

MEASURING NOISE

Due to the range of noise that can be heard by the human ear, a scale called the "decibel scale" is used to represent how loud a particular noise is. A decibel rating describes the relative loudness of the sound.

The sensitivity of the human ear to sound depends on the frequency or pitch of the sound, and some people hear some frequencies better than others. If a person hears two sounds of the same sound pressure but different frequencies, one sound may appear louder than the other. Noise measurement readings can be adjusted to correspond to this peculiarity of human hearing, using the measurement dB(A). The dB(A) unit provides a scale for noise level as experienced or perceived by the human ear, see Table 1 for examples of the dB(A) rating of common sounds.

dB(A)	Loudness	Typical example
0	Threshold of hearing	
20	Extremely quiet	Rustling leaves
30	Quiet	Quiet bedroom
40	Soft	Quiet library
50	Moderately audible	Average home
60	Readily audible	Conversational speech
70	Moderately loud	Vacuum cleaner
80	Loud	Busy road kerbside
90	Very loud	Petrol lawnmower
100	Extremely loud	Petrol chainsaw
120	Threshold of discomfort	Jet taking off
130	Threshold of pain	

Table 1: dB(A) ratings of common sounds.

Most modern air conditioners are designed to operate much more quietly than in the past. However, there is still a significant variation in noise levels across a product size range, and between different manufacturers. Manufacturers test the performance of their products and generally include the operating noise levels in their product literature along with the other performance data.

In some states, manufacturers must display the noise performance data of their equipment on the units.

NOISE LABELLING

Some air conditioners may also have sound pressure levels (L_p) stated on the label. This number is different from the sound power level.

OUTSIDE SOUND POWER LEVEL	60 dBA
(LOWER LEVELS MEAN LOWER OUTSIDE NOISE) THE LEVEL SHOWN MAY BE USED TO ESTIMATE WHETHER THE OUTSIDE NOISE FROM THE PROPOSED INSTALLATION OF THIS UNIT WILL BE WITHIN ACCEPTABLE LIMITS CONSULT YOUR SUPPLIER BEFORE INSTALLATION	
(MANUFACTURER)	(MODEL No.)

Noise labelling of residential air conditioners is a legal requirement in some states in Australia and the introduction of a national noise labelling scheme is currently being considered by the federal government.

Where noise labelling is mandatory, residential air conditioners should have a clearly displayed label which shows the sound power level (L_w) of the outdoor unit.

The sound power level will give you an indication on how noisy the air conditioner will be outside the house. The higher the number, the louder the air conditioning unit will be.

Noise labelling for residential air conditioners provides consumers with more information in order to make informed purchasing decisions. Most of the techniques for estimating noise levels and for determining compliance with local noise regulations will require that the sound power level of the unit is known.

ESTIMATING NOISE IMPACT

Residential air conditioning equipment that is to be installed in a potentially noise sensitive location should be selected for minimal sound power levels. Suppliers and installers should be made aware of the application with regard to the noise sensitivity of the neighbouring premises.

> **Note:** Noise regulations vary from state to state and territory in Australia, and some may specify alternative methods of estimating noise levels. Installers and operators should familiarise themselves with the specific requirements of local regulations and laws.

Occasionally, the owner will purchase a unit separately or refuse to follow the installer's advice with regard to unit location. In such cases, if the installer believes that local noise regulations will not be complied with, the installer should not install the unit or should seek a statement in writing from the owner indemnifying the installer from any future cost of noise mitigation.

A simple method for estimating the likely noise impact of an air conditioner installation on neighbouring properties is outlined below. It shows how to determine the suitable sound power level for a given installation. AIRAH's fairair website (www.fairair.com.au) has an online calculator that can help you through this calculation, or you can follow the steps below.

There are four steps to calculating an air conditioner's sound power level, to see whether it is suitable for a given installation.

You must consider:

1. **The distance factor**
2. **The barrier factor**
3. **The reflection factor.**

From these, you can calculate the sound power level, using the equation:

Distance factor + Barrier factor – Reflection factor = Sound power level dB(A)

The distance factor

The closer the unit is to the neighbour, the quieter it will need to be.

Measure the shortest distance, in metres, between the installation and the appropriate place on the neighbours' property. In some states, the measurement will be to the border fence, in others, to a noise-sensitive room on the neighbour's property, an outdoor entertaining area, or their façade. Mark the distance with an X in the first column of the Acoustic Nomogram (below).

To be safe, air conditioners are best placed in a location that provides the greatest distance between the air conditioner and neighbours.

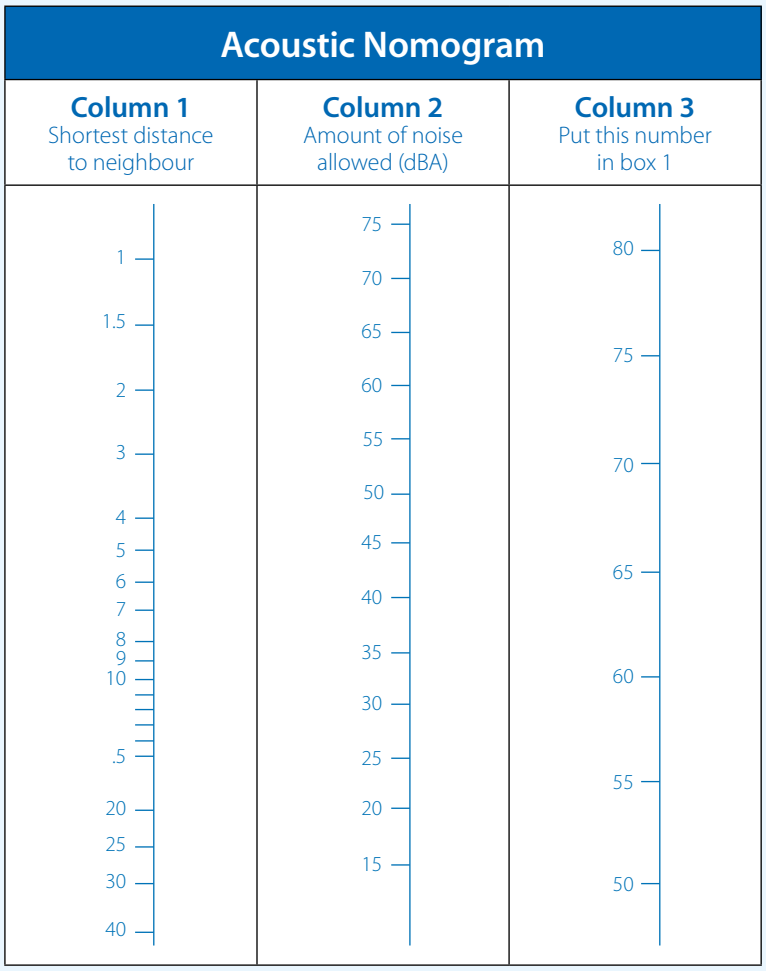
Each state prescribes a different noise level restriction, and assigned noise levels are calculated at the property receiving the noise, not the one emitting it. Before relying on an assigned level for this calculation you will need to consider tonality, which means the characteristic whine or drone. If the tone cannot be reasonably and practicably removed from the noise, the installer will need to compensate for this in the calculation. This can be achieved by subtracting 5dB(A) from the assigned level prior to calculations.

However, in many cases, tonality develops over time, due to age and usage. In general, operating noise levels tend to increase over time and allowances should be made for this in noise calculations.

Once you have considered whether an adjustment for tonality is required, mark the amount of noise allowed in the area with an X in Column 2 of the Acoustic Nomogram.

Draw a straight line from the X in Column 1 through the X in Column 2 to cut through Column 3. This number is the "distance factor".

Acoustic Nomogram



The barrier factor

A fence or barrier can reduce the level of air conditioner noise heard in neighbouring premises, but it must be continuous or solid, with very few gaps, particularly where it meets the ground. The fence or barrier must also prevent the air conditioner being seen from noise sensitive locations on neighbouring premises. Noise-sensitive locations include windows of bedrooms and living rooms (including those of multi-storey dwellings) and outdoor entertaining and relaxing areas.

Carefully read through the fence/barrier descriptions below starting at a). Select a value that corresponds to the fence/ barrier description applicable to your situation – this is your barrier factor. If in doubt about your fence type, select a low value, and for roof-mounted refrigerated units, the barrier factor will equal "0".

a)	The fence/barrier does not prevent the air conditioner being seen from between the air conditioner and noise sensitive locations on the neighbouring premises.	0
b)	The fence/barrier only just blocks the "line of sight" and it is made of material having gaps, such as a standard picket fence or a brick fence with fancy iron inserts.	0
c)	The fence/barrier only just blocks "line of sight" and is made of solid material.	5
d)	Fence/barrier with gaps, e.g.: • Hedges/bushes/trees • Tea tree/brush • Picket fence • Fence in disrepair with holes or missing planks • Wire mesh fence • Masonry fence with decorative open inserts.	0
e)	The fence/barrier completely blocks "line of sight" of the air conditioner from noise sensitive locations. Typical paling fence e.g. Planks overlapped by 25mm planks, 13mm thick. Air gaps between palings due to warping, etc. 	6
f)	Solid fence with no gaps and flush to the ground e.g. • Galvanised iron • Fibre cement sheeting • 20mm pine planking with 35mm overlap 	10
g)	Concrete block / masonry / brick 	10

Reflection factor

Just as light reflects from mirrored surfaces, sound will reflect from walls, carports, roofs and the like. Find a diagram below that best corresponds to the placement of the air conditioner – is there one reflective surface (gives a value of three), or two reflective surfaces (gives a value of six)?

One reflective surface — Reflection factor = 3

on side of building, or ground (less than 3m from building) = 3

on roof = 3

Two reflective surfaces — Reflection factor = 6

on ground = 6

on side of building = 6

between two walls = 6

on roof = 6

under carport= 6

Using the values of the distance, barrier and reflection factors placed into the above-mentioned equation, calculate the outdoor unit maximum sound power level (expressed in dB(A)) that can be installed in the position you are considering. Refrigerated domestic air conditioners should be labelled with their outside sound power level. ▲

MORE INFORMATION

The information in this month's Skills Workshop is adapted from AIRAH's Residential Air Conditioning Best Practice Guidelines, which is available free online at www.airah.org.au, under the "Resources" tab. Additionally, visit www.fairair.com.au to use the online noise calculator, or view additional residential air conditioning information.

Next month: **Residential Noise Issues – Part 2**