



AIR CONDITIONING RESIDENTIAL BEST PRACTICE GUIDELINE (*Western Australia*)

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Foreword

The use of residential air conditioning systems in Australian homes has steadily increased over the last 10 years. Currently there are over 650,000 residential air conditioners sold in Australia annually and forward estimates indicate that this figure will continue to rise. The increase in use of residential systems has generated an increase in complaints about noisy air conditioners.

Noise is an integral part of our society today. No-one can escape noise completely, but if our towns and cities are to remain liveable, it is important to manage the negative impacts of environmental noise on people within their homes.

As a supplier, installer and maintainer of residential air conditioning systems, you have a professional obligation to make sure that every practical and reasonable effort is made not to compromise our quality of life through noise related issues.

AIRAH is pleased to be involved in the development of these guidelines which are aimed at improving installation practices thereby minimising and reducing inappropriate noise from air conditioning systems.

This document represents an important step forward in coordinating Council, community and industry action in managing environmental noise. It contains fundamental guidelines to protect both yourself and your customer from actions that may result in fines and/or legal action.

Follow the basic steps outlined in this booklet and help "design out the problem".



Jennifer Pelvin
Chief Executive
AIRAH

Purpose and application

The purpose of this Best Practice Guideline is to define a minimum level of service that AIRAH considers should be delivered by a Supplier* in order to provide a quality result for a Customer. AIRAH does not monitor or control Suppliers who may use this Guideline and is not a party to any contract with which it may be used.

This Guideline is primarily intended to apply to air conditioning or heating systems for single residential dwellings, including individual apartments in a multi-residence building. It may also be used for individual small commercial systems, but does not apply to large or complicated commercial systems.

AIRAH has endeavoured to provide information that is relevant to typical residential air conditioning applications and that is correct at the time of publication. AIRAH may update this document from time to time, and will make updates available. However, it is the responsibility of the Supplier to ensure that all work is carried out in compliance with all current Legislation and the requirements of all applicable Standards, Codes and state and local Authorities.

Intent

The intent of this Guideline is:

To enable all Suppliers to provide refrigerative air conditioning and heating systems that adequately meet the customer's needs and to minimise the risk of any Supplier bringing the industry into disrepute by:

- Using equipment that can't deliver its stated capacity.
- Offering to install equipment without accurately calculating how much cooling or heating (duty) is really needed.
- Installing equipment so that it can't meet the required duty or be properly maintained.
- Using unqualified, unskilled, unlicensed and/or inexperienced tradespersons to specify and install the equipment.

To give the Customer confidence that the selection of an air conditioning or heating system will meet their expectations of satisfactory operation and price, by:

- Noting the maximum/minimum ambient conditions at which the system will satisfy indoor temperatures.
- Ensuring alternative choices of equipment or systems are offered.
- Explaining all aspects of the price: inclusions, exclusions, maintenance work and likely additions.
- Stating what sort of service is really required and the cost of this service, indicating what has been included (and excluded) from any service agreement in the contract.

* The term suppliers in this document refers to: suppliers, specifiers, installers and those maintaining air conditioning equipment

Objectives for Suppliers

The objectives of this Guideline are to ensure that the Supplier:

- Identifies the needs of the Customer.
- Provides professional advice and a written quotation.
- Provides a system that meets the identified needs of the Customer.
- Provides good quality equipment and installation.
- Provides professional after-sales service.

Meeting the objectives of this guideline

The following items should be adhered to:

1. Educate your staff in this Best Practice Guideline.
2. Employ qualified trades people and ensure that all installation work is carried out under the supervision of a person licensed / registered for air conditioning / refrigeration work.
3. Tell your prospective customer that your firm designs systems and then selects, supplies, installs and commissions equipment, all in accordance with the AIRAH Residential Air Conditioning Best Practice Guideline.
4. Make sure that you know what your customer's real needs are, in regard to air conditioning and heating. Do they want:
 - A low price, or are they prepared to pay for the best possible air conditioning system?
 - Year-round comfort in all rooms, or just relief from outside extremes on the hottest or coldest days only?
 - Absolutely minimal noise that won't disturb the lightest sleeper, or a reasonably loud "drone"?
 - A system that makes it visually obvious that the home is air conditioned or one that is almost "invisible"?
 - Minimal running costs, or are running costs not an important issue?
 - A high efficiency unit defined by a high star rating.
5. Make sure that your customer knows what your proposal will really achieve. Does the customer:
 - know it will take time to cool-down or heat-up a home during extreme weather?
 - expect more rooms to be air conditioned than you are offering?
 - know the likely running costs per day? (or over the whole year?)
 - really know what noise level to expect from a residential air conditioning system?
 - know what it will look like, indoors and outdoors?

6. Cooling and heating load estimates must only be carried out by experienced personnel, or under the supervision of experienced personnel, and include appropriate allowances for internal loads, infiltration, fan gains and duct heat gain/loss. The Supplier shall retain calculations on file for the duration of the warranty period.
7. Design outdoor conditions should be selected from AIRAH DA09, Load Estimation & Psychrometrics 'comfort' criteria for the nearest location, adjusted if necessary for the actual local climate. Note that design conditions only a few kilometres inland may be quite different from coastal locations.
8. Equipment selection must be based on the design indoor and outdoor conditions, adjusted if necessary to account for the installed plant configuration (e.g. heat gain from surroundings, recirculation). Unit capacity must be capable of achieving both the calculated sensible and total loads.
9. Where the building occupant does not plan to operate the plant continuously, but will switch it on say, after returning home on a very hot (or very cold) day, an appropriate "cool-down/warm-up" allowance must be included in the calculated loads so the system has sufficient reserve capacity to reach comfort conditions in a reasonable time.
10. Ensure that your staff are familiar with the Australian Standards, Codes and Legislation applying to the installation and have access to appropriate reference documents. Refer to the AIRAH Residential Air Conditioning Best Practice Guideline.
11. Install systems with adequate space and access to carry out proper maintenance. Where the Customer is unwilling to provide adequate space or access, explain and confirm in writing the likely effect in terms of ongoing costs and unsatisfactory or reduced plant life.

Compliance

A Supplier shall not advertise use of this Best Practice Guideline unless it is used and fully complied with on all applicable projects (except when specifically excluded by the Customer).

Compliance with this Guideline involves completion of all requirements that are relevant to the project, as initialled on the copy of this Guideline supplied with the quotation. The Supplier will indicate compliance with the Best Practice Guideline by completing the Data Form on the last pages of this booklet and leaving it with the Customer.

The following checklist should be adhered to by the Supplier.

BEST PRACTICE CHECKLIST	
Phase	
QUOTATION	Arrive at the agreed time. If an appointment cannot be kept, advise the Customer in advance and agree an alternative time.
	Inspect the site and discuss the Customer's requirements to identify their needs.
	Suggest alternatives if appropriate. If requested, provide indicative pricing for each.
	Agree the system type to be used.
	Determine required equipment capacity using an appropriate calculation method.
	Determine Local Council requirements (if any) in relation to the works.
	<p>Provide a detailed quotation including:</p> <ul style="list-style-type: none"> • Calculated heating and cooling capacity, stating calculation method used, indoor and outdoor temperatures for Summer and Winter used for calculations and expected indoor temperature tolerances. • Description of the system to be provided (equipment manufacturer, heating and cooling capacity at stated indoor and outdoor conditions, noise levels, number and location of outlets, zones, controls and the like). • Statement on required/recommended noise levels and the extent of the Supplier's responsibility. • Price and payment schedule. • Inclusions and exclusions (Council application/fees/requirements, power supply, supports/plinth, drainage, covers for exposed piping and wiring, cleanup, rubbish removal and the like).

BEST PRACTICE CHECKLIST	
Phase	
QUOTATION	<ul style="list-style-type: none"> • Warranty (length, conditions and exclusions). • Insurance (what is and is not covered by the Supplier's policy). • Details of recommended servicing frequency and exclusions. Nominate price of full service for first year. • A copy of this Best Practice Guideline, with initials against the requirements that will be completed. • Declaration by a management representative that the work will be carried out in accordance with this Best Practice Guideline.
	A 10 day cooling off period applies to door to door sales. Otherwise no cooling off period applies.
	Check local regulations on the type of warranty to be provided
INSTALLATION	Utilise equipment from established manufacturers capable of providing spare parts and technical backup.
	Ensure installation is performed by, or under the supervision of qualified, licensed/registered personnel.
	Ensure equipment, materials and installation is in accordance with all relevant legislation and Australian Standards and Best Practice Programs.
	Commission the equipment with calibrated instruments and an established checklist, using experienced personnel. A copy of the completed checklist shall be provided to the Customer.
	Provide the Customer with operating instructions and a (brief) schedule of recommended maintenance.
AFTER SALES	For at least two years after installation, remind the Customer when a routine service is recommended. Service visits for the first year shall be at the fixed price nominated in the quotation.
	Utilise a service checklist and provide a copy to the Customer after each service.
	Promptly attend to any defects identified during the warranty period.

Noise Issues

What is Noise?

When environmental noise reaches elevated levels in our living spaces, it can have significant impacts on our health and well being by disturbing sleep and interfering with relaxation and communication.

Noise by definition is sound that is unwanted or unpleasant in some way. Due to the range of noise that can be heard by the human ear, a scale

was developed called the 'decibel scale' (dB(A)), which is used to represent how loud a particular noise is.



How does noise affect us?

When noise becomes too loud in our living places, it can have significant impact on our health and wellbeing by disturbing and preventing sleep, 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.

Sleep disturbance

Sleep is necessary for the basic physical and mental functioning of healthy people. Noise can interfere with sleep in a number of ways.

It can:

- prevent people from falling asleep
- cause awakenings
- interrupt quality of sleep
- affect performance and mood the next day

Research also indicates exposure to night time noises also induce secondary effects, so-called after effects. These effects that can be measured the day after the night-time disturbance and are detected while the individual is awake. The secondary effects include reduced perceived sleep quality, increased fatigue, depressed mood or well-being, and decreased performance.

Research has shown that sleep disturbance is complex and dependant on a number of factors, including the level of nuisance noise compared with the background noise, frequency of the noise and the percentage of low-range components within the nuisance noise. This combined with particular individual attributes (such as stress levels, medical conditions and level of hearing) can all lead to sleep disturbance.

Annoyance

The term 'annoyance' is typically used to sum up the negative emotions people express to unwanted noise that impacts on their ability to undertake activities such as sleeping, relaxing or reading. These emotions can include anger, dissatisfaction, agitation and helplessness.

Annoyance levels are influenced by:

- the level of noise
- type of noise
- how often it occurs
- how long it goes for
- the time of day or night
- psycho-social factors such as the individuals ability to shut out the noise, their emotional status and disposition to the noise



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.

Residential appliance noise

Changing lifestyles and new technologies have seen the increased use of powered appliances. Air conditioner noise complaints made to city councils have greatly increased over the past few years and may be attributed to a number of factors including a decrease in distance between neighbours due to an increase in high density living, combined with an increase in domestic air conditioning sales.



Installers' Legal Responsibility for Noise

It is very important that installers understand they can be held legally responsible if equipment they have installed exceeds prescribed noise limits, and they can incur heavy fines if convicted.

Section 80(1) of the *Environmental Protection Act 1986* generally states that a person who installs any equipment which emits unreasonable noise commits an offence. Section 80(2) generally states that if the occupier of a premises is convicted of committing an offence under the Act, they can recover the cost of fines and court fees from the installer. The penalty for an offence under section 80(1) is \$5000 for an individual or body corporate. See page 29 for where to obtain a full copy of the Act.

It is also worthwhile to note that legal responsibility is not placed on the retailer or supplier. Suppliers should be aware that installers may not legally be able to install equipment if it creates excessive noise.

Allowable Noise Levels

The *Environmental Protection (Noise) Regulations 1997* include noise limits for air conditioners. Local governments are responsible for enforcing these limits at houses and units. There are different assigned levels for different times of day. For each time period there are three separate noise levels that air conditioners must comply with. These levels relate to what proportion of time different levels of noise are allowed for.

- L_{A10} means a noise level which is not to be exceeded for more than 10% of the time, eg for more than 10 minutes in 100 minutes.
- L_{A1} means a noise level which is not to be exceeded for more than 1% of the time, eg. For more than one minute in 100 minutes.
- L_{Amax} means a noise level which is not to be exceeded at any time.

In terms of air conditioner noise, L_{Amax} might be used to measure a sharp, loud banging noise that occurs for less than 1% of the time

the air conditioner is on. The body of the noise would then be measured using L_{A10} to ensure that the majority of the noise does not exceed this lower level.

The noise levels also need to be adjusted according to their influencing factor, which accounts for the amount of industrial and commercial land and major roads within a 450 metre radius of the property. The purpose of incorporating the influencing factor is to take into account background noise levels which occur in different areas. Air conditioners will be less audible if there is a lot of background noise. Including this factor ensures residents in noisy areas are not disadvantaged by having to comply with the same levels as quiet areas.

In a lot of cases the influencing factor will be zero because most residential properties are in fully residential areas, ie, not near any major roads or commercial or industrial land. For properties near major roads or non-residential areas, the influencing factor can be obtained by contacting local councils, who can perform calculations for particular areas. Different councils have different methods of making these calculations. Some councils have software which allows them to calculate influencing factors automatically, and some councils need to refer to maps and make manual calculations, so some councils may be more prepared to calculate values than others. Otherwise, installers can make this calculation themselves if they choose, which will involve obtaining a council zoning map. Calculations for the influencing factor are explained in Appendix A.

All noise measurements are taken on the property **receiving** the noise, not the property of the air conditioner owner.

The noise levels below are for residential areas with close dwellings like houses and flats in suburban neighbourhoods. Different levels apply for residential areas on large properties like farms, and also for commercial and industrial premises. Refer to the Department of Environmental Protection for details on these types of premises (see page 37).

The assigned noise levels are:

Time of day	Noise level (dB(A))		
	L _{A10}	L _{A1}	L _{Amax}
7am to 7pm Monday to Saturday	45 + influencing factor	55+ influencing factor	65+ influencing factor
9am to 7pm Sunday and public holidays	40 + influencing factor	50+ influencing factor	65+ influencing factor
7pm to 10pm all days	40 + influencing factor	50+ influencing factor	55+ influencing factor
10pm on any day to 7am Monday to Saturday and 9am Sunday and public holidays	35 + influencing factor	45+ influencing factor	55+ influencing factor

The levels **measured** also need to be adjusted according to the noise character of the air conditioner. This includes:

Characteristic	Description of sound	Adjustment to measured level
Tonality	Whining or droning	+5dB
Modulation	Like a siren, changing pitch	+5dB
Impulsiveness	Banging or thumping	+10dB

These adjustments can add up to a maximum of 15dB. The adjusted levels need to comply with the assigned maximum levels above.

To avoid the risk of legal complications, it is important to select the quietest air conditioner possible and have it installed as far away as possible from any surrounding dwellings / houses.

Noise Labelling

Residential air conditioners should have a label clearly displayed which shows the Sound Power Level (L_w) of the unit. This is a legal requirement for refrigerative systems under the *Noise Abatement (Noise Labelling of Equipment) Regulations (No.2) 1985*.

The Sound Power Level will give you an indication on how noisy the air conditioner will be outside the customer's house. The higher the number, the louder the air conditioning unit will be.

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 ABOVE 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.)

Education

Noise issues associated with the use of appliances such as air conditioners are often the result of the operators being unaware that their actions are adversely affecting neighbours. Operators are also unaware that by exceeding noise levels, they are breaking the law and legal action could result.

Raising people's awareness of noise nuisances and potential penalties that may apply will ensure reduction of these nuisances.

Likewise, limited advice from retailers and installers, and lack of forethought and planning by owners, retailers and installers on the location and use of air conditioners also contributes to noise impacts in the community.

Installers have a community obligation as well as a legal responsibility to provide responsible advice and service to prevent noise nuisance up-front.

Noise labelling for domestic air conditioners, providing consumers with more information in order to make informed purchasing decisions.



Enforcement

- Local city councils have Environmental Health Officers who handle complaints about residential air conditioners.



Councils regulate noise impacts from air conditioners using the *Environmental Protection (Noise) Regulations 1997*. The regulations prescribe:

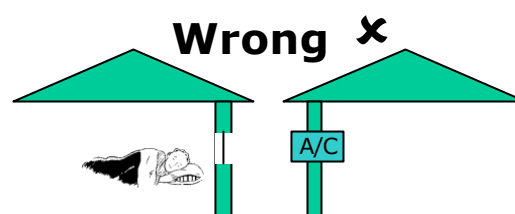
- Noise level restrictions for different times of day or night
- Powers for local government to issue on-the-spot fines of \$250 for a first offence and \$500 for offences thereafter
- Powers for local government to issue Environmental Protection Notices
- Powers for local government to seize air conditioners

Practical steps to minimise air conditioner noise

Where will the air conditioner be installed?

Consider where the air conditioner is likely to be installed. Some air conditioning systems are quieter than others and some have more flexibility in where they can be located.

Air conditioners should not be located adjacent to neighbours windows, bedrooms or living areas.



Split systems have more flexibility in the way they are installed and the outside unit can be located closer to the ground. This allows fences and barriers to be used to screen the noise from the unit.

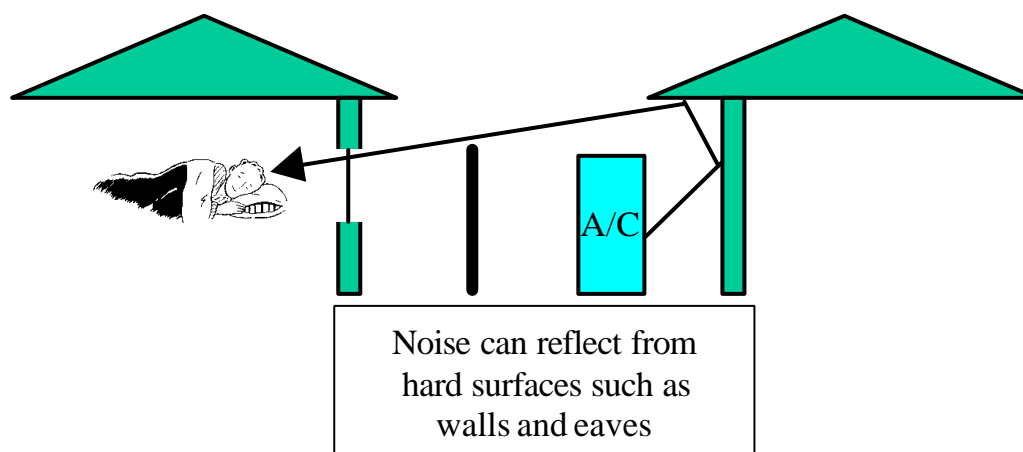
"Discuss noise issues with your customer before the air conditioner is installed."

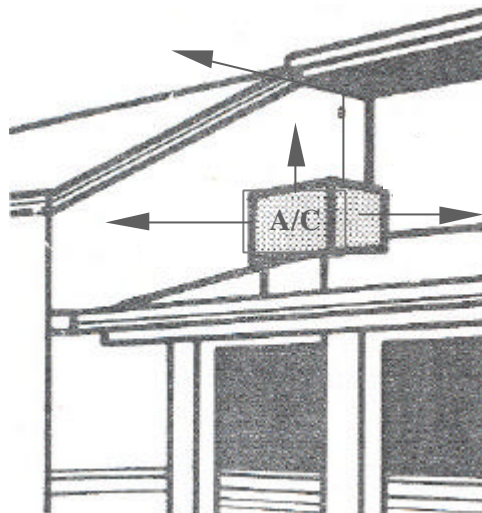
Make use of barriers for screening

Just as light reflects from shiny surfaces, noise can be reflected from hard surfaces onto neighbour's property.

Avoid locating the air conditioner near multiple reflective surfaces such as walls and eaves.

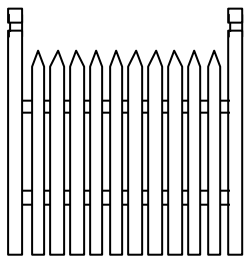
Existing barriers such as fences and garden walls can be used to effectively screen noise from neighbours. It is important to make sure that any barriers used to screen neighbours from noise blocks the line of sight of the air conditioner and does not contain any holes or gaps.





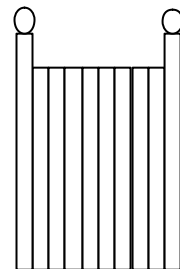
Try and avoid multiple reflective surfaces when air conditioner is facing neighbours

A solid fence, which completely blocks line-of-sight of the air conditioner and contains no gaps, may help you to reduce your air conditioner noise to acceptable limits.



✘ Wrong

Too many holes and gaps



✓ Right

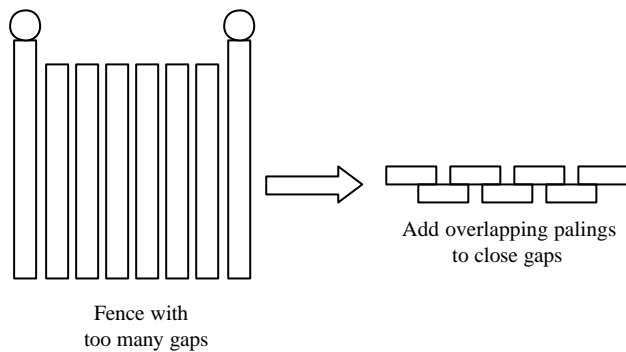
Solid fence with no gaps

Acoustic Barriers

If the air conditioner is well maintained and operating properly, but is still causing excessive noise, consider the use of acoustic barriers.

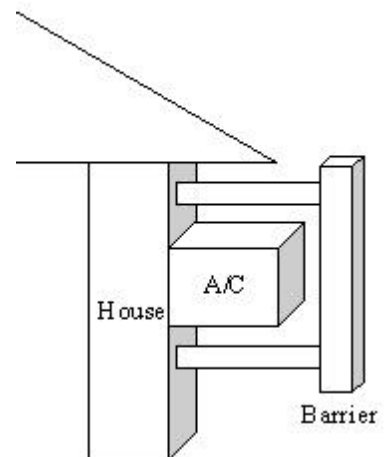
Fences and garden walls can be used effectively to screen neighbours from noise, however to be effective, any fences or walls must block the line of sight of the air conditioner, be of solid construction and contain no gaps or holes.

If a dividing fence is located between the air conditioner and the neighbour, it may be constructed of standard wooden palings with gaps between the palings. The fitting of additional overlapping palings could make an existing fence an effective noise barrier.



If room permits, an air conditioning barrier could be a cost effective option. In order for this to be effective, the barrier must block line of sight to the affected neighbours and the air conditioner must be located away from multiple reflective surfaces, such as corners and eaves, which could reflect noise and decrease the effectiveness of the barrier.

Air conditioning outdoor units require ventilation to operate. Any barriers must be constructed in accordance with manufacturer specifications for ventilation to avoid damage to the outdoor unit.



Air Conditioning Enclosures

There are a number of companies that market full noise enclosures for air conditioning units.

Also check with the manufacturer of your air conditioner to see whether they have any after market sales of noise enclosures.

"Always make sure when enclosing air conditioning units that you check the manufacturers' specifications for ventilation, to avoid damage to the outdoor unit and voiding of the warranty."

Estimating the Noise Impact on Neighbouring Properties

The following pages give simple methods to estimate the likely noise impact of an air conditioner installation on neighbouring properties. If you want to determine the suitable "Sound Power Level" for a given installation then follow the steps for - *Determining a Suitable Sound Power Level*.

If you have already selected a unit and know the "Sound Power Level" and want to know how close to a neighbouring property or fence it can be located, follow the steps for - *Determining Distance to Boundary*.

Determining a Suitable Sound Power Level

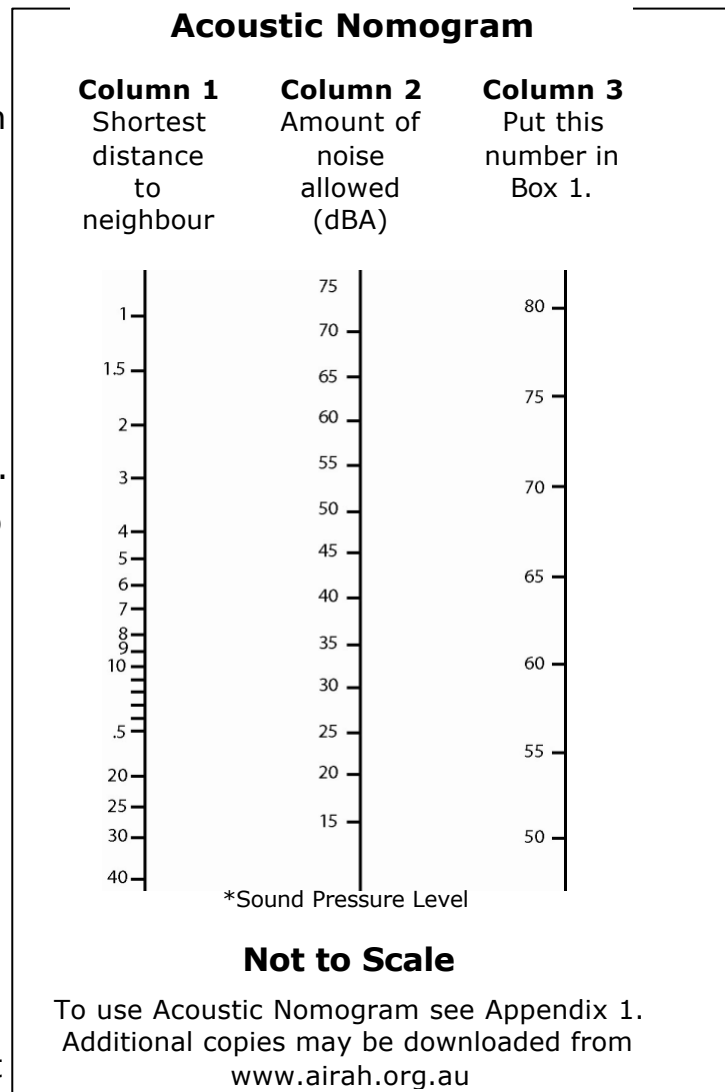
Follow **Steps 1- 4** carefully and it will guide you to decide which air conditioner is suitable by considering the distance between the intended site and property boundary, as well as noise barriers such as fences.

Step 1 Distance Factor

The closer the air conditioner is to the neighbour the quieter it will need to be. Follow the steps below and put your answer in **Box 1**.

- a) Measure the shortest distance, in metres, between where you want to put the air conditioner and a noise sensitive area on the neighbouring property. The nearest noise sensitive area may be the façade of the neighbour's house or an outdoor entertaining area or patio. If unsure, the safest method is to take the shortest distance between the unit and the boundary fence with an additional allowance for the minimum setback on the neighbour's side (typically one metre). Mark the distance with an X in Column 1 - Acoustic Nomogram.

- b) Bear in mind that to reduce noise, air conditioners are best placed in a location that provides the greatest distance between the air conditioner and neighbours. This could, for example, mean mounting the air conditioner facing the back fence or front street (check Town Planning constraints first).



- c) For the majority of residential properties the assigned level will be the base value of 35dB(A) sound pressure level for the overnight period from 10pm until 7 or 9am the following morning. This level will need to be adjusted by adding its influencing factor if the property is near any major roads or commercial or industrial land. Assigned noise levels are calculated on the property receiving the noise. Measurements are not made at the property emitting the noise.
- d) mark the amount of noise allowed in the area with an X in Column 2 - Acoustic Nomogram.
- e) Draw a straight line from the X in Column 1 through the X in Column 2 to cut through Column 3 - Acoustic Nomogram.
- f) Read the number from Column 3 - Acoustic Nomogram, where the line you have just drawn crosses, and write this in **Box 1**.

Distance Factor

BOX 1	
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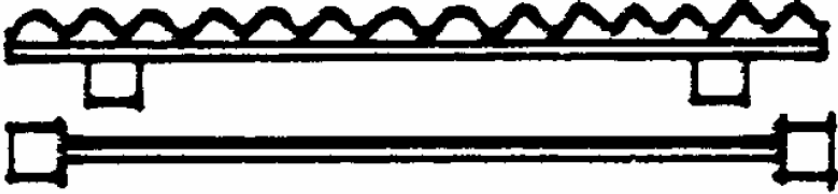

Step 2 Barrier Factor

If there is a fence or wall between the neighbouring properties the noise may be reduced. Check this below and put your answer in **Box 2**.

A fence or barrier can reduce the level of air conditioner noise heard in neighbouring premises. To do this a fence or barrier will need to be continuous or solid. It should contain very few gaps, particularly where the fence 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. Put this value in **Box 2**.

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. <ul style="list-style-type: none">• 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)	<p>The fence/barrier completely blocks "line of sight" of the air conditioner from noise sensitive locations.</p> <p><i>Typical paling fence e.g.</i> Planks overlapped by 25mm planks, 13mm thick. Air gaps between palings due to warping etc.</p> 	6
f)	<p><i>Solid fence with no gaps and flush to the ground e.g.</i> Galvanised iron Fibre cement sheeting 20mm Pine planking with 35mm overlap</p> 	10
g)	<p><i>Concrete block / masonry / brick</i></p> 	10

Note:

- If in doubt about your fence type, select a low value.
- For roof mounted refrigerated units, place "0" in Box 2 – Barrier Factor.

Barrier Factor

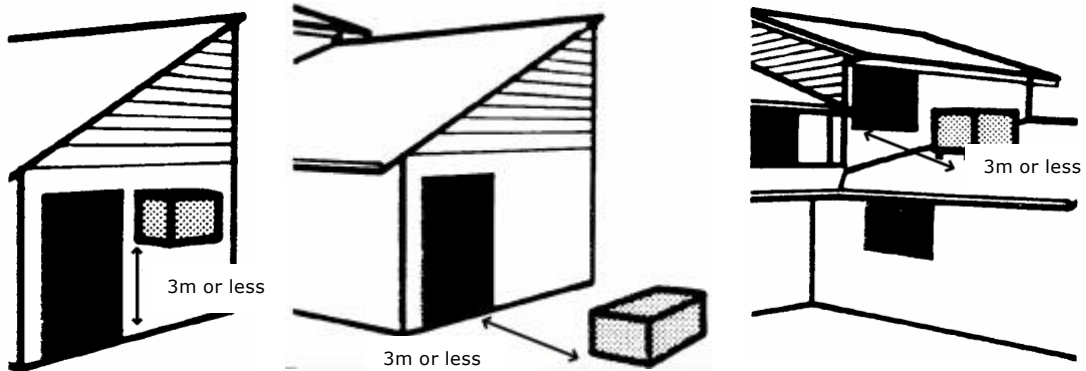
BOX 2	
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Step 3 Reflection Factor

Noise can reflect off walls and make the air conditioner appear louder. From the examples below, determine the best fit for your situation and put your answer in **Box 3**.

Just as light reflects from mirrored surfaces, sound will reflect from walls, carports, roofs and the like. Find a diagram below which best corresponds to the placement of the air conditioner. Put the corresponding value in **Box 3**.

One Reflective Surface

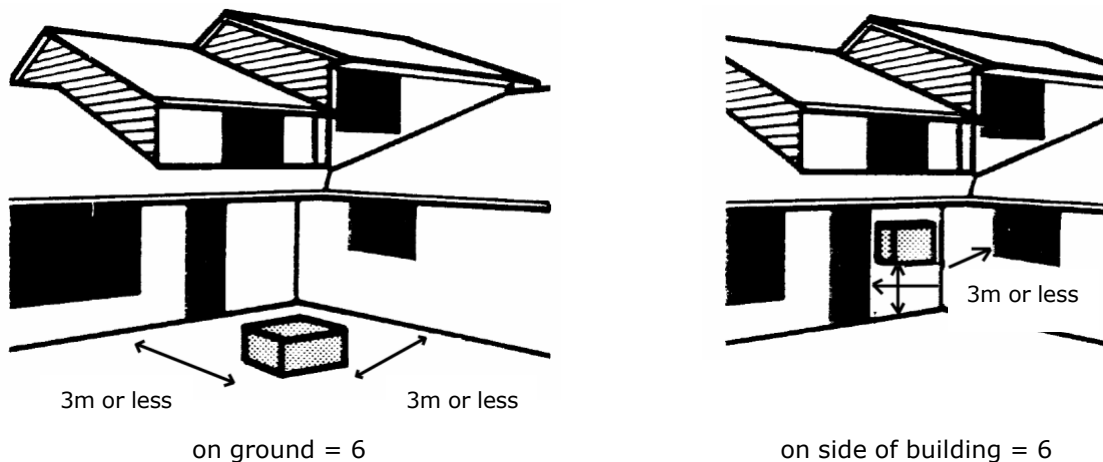


on side of building = 3

on ground = 3

on roof = 3

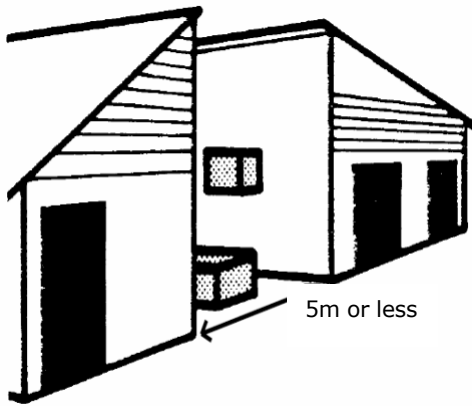
Two Reflective Surfaces



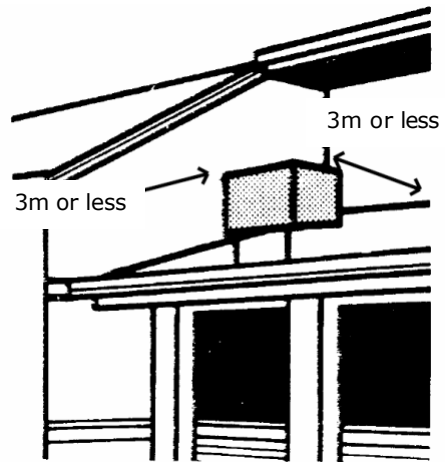
on ground = 6

on side of building = 6

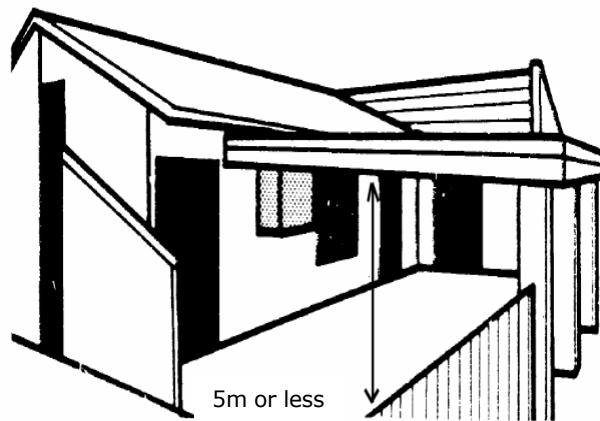
Two Reflective Surfaces



between two walls = 6

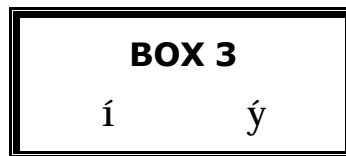


on roof = 6



under carport = 6

Reflection Factor



Step 4 Sound Power Level dB(A)

(= Answer) Add the numbers in **Box 1** and **Box 2**, then subtract the number in **Box 3**.

Transfer all your Answers here and complete the equation.

Distance Factor	+	Barrier Factor	-	Reflection Factor	=	Sound Power Level dB(A)
BOX 1 í ý		BOX 2 í ý		BOX 3 í ý		ANSWER í ý

The answer is 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 must be labelled with their outside sound power level.

"As a Supplier you will need to know the sound power level of any air conditioning unit you intend to install."

EXAMPLE

Determining a Suitable Sound Power Level

For this example assume the noise limit is 35dB(A), the lowest possible level for the overnight period between 10pm and 7 or 9am if the influencing factor is zero.

Step 1

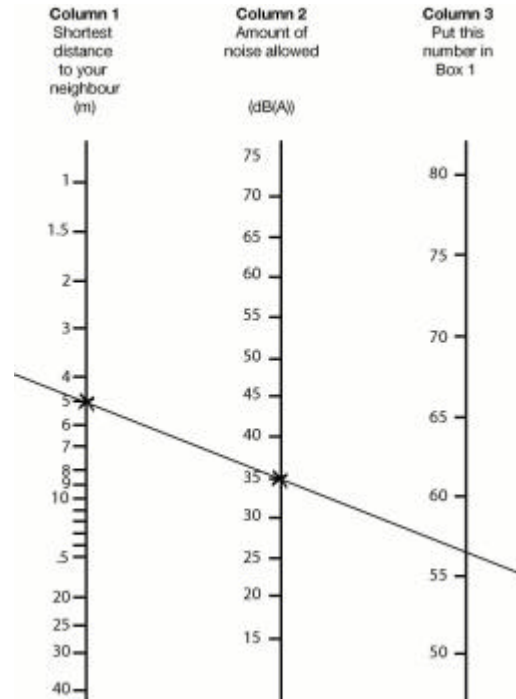
You plan to locate the air conditioner 5 metres from the neighbour's patio so you put a mark at 5 in Column 1. The assigned level at the neighbours property should not exceed 35dB(A) so you put a mark at 35 in Column 2 of the Acoustic Nomogram. Joining these two points with a straight line through column 3 of the Acoustic Nomogram gives a value of 57.

Step 2

The fence between the air conditioner and neighbours would block the "line of sight" and is made of wooden overlapped planks. Put 6 in Box 2.

Step 3

The air conditioner will be located on the ground against the house wall and more than 3 metres from any other wall surface. Put 3 in Box 3.



Distance Factor	+	Barrier Factor	-	Reflection Factor	=	Sound Power Level dB(A)
BOX 1 í 57ý		BOX 2 í 6ý		BOX 3 í 3ý		ANSWER í 60 dB(A)ý

You have determined that the Sound Power Level for an air conditioner to be installed at this particular location should not exceed 60 dB(A). It may be possible to locate a unit with a higher Sound Power Level at this location if an appropriately designed acoustic enclosure is built around it. This should only be considered under the advice of a suitably qualified person otherwise damage to the unit or a fire hazard may result.

If it is estimated or anticipated that noise levels will exceed allowable limits, Suppliers must raise potential issues and solutions with the Customer before a location is finalised.

Determining Distance to Boundary

Determining the distance to the boundary for a known air conditioner is simple. This time the known values are Sound Power Level (from the unit), Barrier Factor and Reflection Factor.

The distance value is determined as follows:

$$\text{Column 3} = \text{Sound Power Level dB(A)} + \text{Reflection Factor} - \text{Barrier Factor}$$

Column 3	=	Sound Power Level dB(A)	+	Reflection Factor	-	Barrier Factor
Answer						
í ý		í ý		í ý		í ý

The value from the above answer box is marked in Column 3 of the Acoustic Nomogram. Draw a straight line through this mark and a similar mark in Column 2 representing the noise level allowed in the area.

This straight line is extended through Column 1 to find the minimum distance in metres that the unit should be set back from the nearest boundary.

It may be possible to locate the unit closer to the boundary if an appropriately designed acoustic enclosure is built around it. This should only be considered under the advice of a suitably qualified person otherwise damage to the unit or a fire hazard may result.

If it is estimated or anticipated that noise levels will exceed allowable limits, Suppliers must raise potential issues and solutions with the Customer before a location is finalised.

Load Estimation

The Supplier will determine the required equipment capacity using an appropriate method and means of calculation, using their best professional judgement and provide the details of the basis of this determination to the customer. Load estimation shall be performed only by personnel experienced in doing these calculations or under the supervision of other experienced personnel.



Legislation, Regulations, Standards and Reference Material

Current legislation, regulations, standards and reference material is correct at the time of publication. It is the responsibility of the Supplier to ensure that all work is carried out in compliance with all current Legislation and the requirements of applicable Standards, Codes and Authorities.

Western Australia Legislation

- Environmental Protection (Noise) Regulations 1997
- Environmental Protection Act 1986
- Noise Abatement (Noise Labelling of Equipment) Regulations (No.2) 1985
- Environmental Protection (Ozone Protection) Policy 2000

Copies of the legislation can be purchased from:

State Law Publisher
Ground Floor
10 William Street
Perth WA 6000

Phone (08) 9321 7688
Website www.slp.wa.gov.au

Commonwealth Legislation

- Trade Practices Act 1974

Codes

- Building Code of Australia
- SAA HB40: The Australian Refrigeration and Air conditioning Code of Good Practice - Reduction of emissions of fluorocarbons

Australian Standards

The Supplier shall comply with all relevant requirements of any Standards that are called up by Legislation, Codes or Authorities. Even if not mandated in legislation, AIRAH recommends compliance with the latest edition of the following Standards including, but not limited to:

AS1055:	Acoustics - Description and measurement of environment noise
AS1668.2:	The use of mechanical ventilation and air conditioning in buildings - Mechanical ventilation for acceptable indoor air quality
AS1677:	Refrigerating systems
AS2107:	Acoustics - Recommended design sound levels and reverberation times for building interiors
AS2913:	Evaporative air conditioning equipment
AS3000:	SAA Wiring Rules
AS 3102:	Approval and test specification for electric duct heaters
AS/NZS3018:	Electrical installations - Domestic installations
AS/NZS3350:	Safety of household and similar electrical appliances, Part 2.40 - Electrical heat pumps air conditioners and dehumidifiers
AS3823:	Performance of electrical appliances - Air conditioners and heat pumps
AS4254:	Ductwork for air-handling systems in buildings
AS4269:	Complaints handling
AS4426:	Thermal insulation of pipework, ductwork and equipment - Selection, installation and finish

AIRAH Reference Material

AIRAH recommends reference to the following documents:

- DA 02: Noise Control
- DA 03: Duct Design
- DA 08: Introduction to HVAC&R
- DA 09: Load Estimation & Psychrometrics
- DA 19: HVAC&R Maintenance
- DA 20: Humid Tropical Air Conditioning
- RS1: Refrigerant Selection Guide 2003

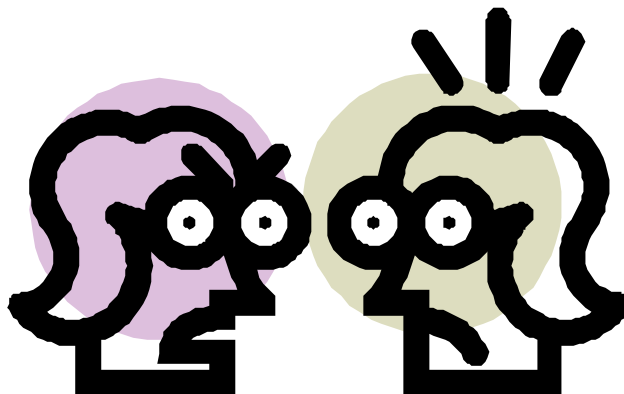
Dispute Resolution

If a Customer is not satisfied with an air conditioning or heating installation carried out in accordance with the AIRAH Residential Air Conditioning Best Practice Guideline, a management representative of the Supplier shall investigate the complaint in a timely manner.

In the event of an omission or failure to comply with the relevant requirements of the Guideline, the quotation, any formal contract entered into for the works or to any other matter which the Supplier has a common law obligation to address, the Supplier shall promptly rectify the omission or failure.

If the Supplier determines that no such omission or failure has occurred and that the complaint is not justified, the management representative shall provide a written response to the Customer outlining the reasons why, and suggesting the informal or formal dispute resolution procedures that may be employed if the Customer is still not satisfied.

It is recommended that the dispute resolution procedures are included in the quotation or any formal contract entered into for the works. The Supplier should specify the relevant authorities and agencies appropriate for handling disputes in their State or Territory.



Where to get more help

Department of Environment and Conservation

Phone 08 6364 6500
Website www.dec.wa.gov.au
Look For Environmental regulations

Department of Environment and Heritage

Phone (02) 6274 1888
Website www.greenhouse.gov.au
Look for Your Home - information to help control your indoor living environment while reducing energy consumption.
Energy rating - information on buying energy efficient appliances.

Australian Institute of Refrigeration, Air Conditioning & Heating (AIRAH)

Phone 03 8623 3000
Website www.airah.org.au
Look for Reference material

Australian Refrigeration Council (ARC)

Phone 1300 884 483
Website www.arctick.org
Look for Authorised organisations

Department of Consumer and Employment Protection

Phone 1300 136 237
Website www.docep.wa.gov.au

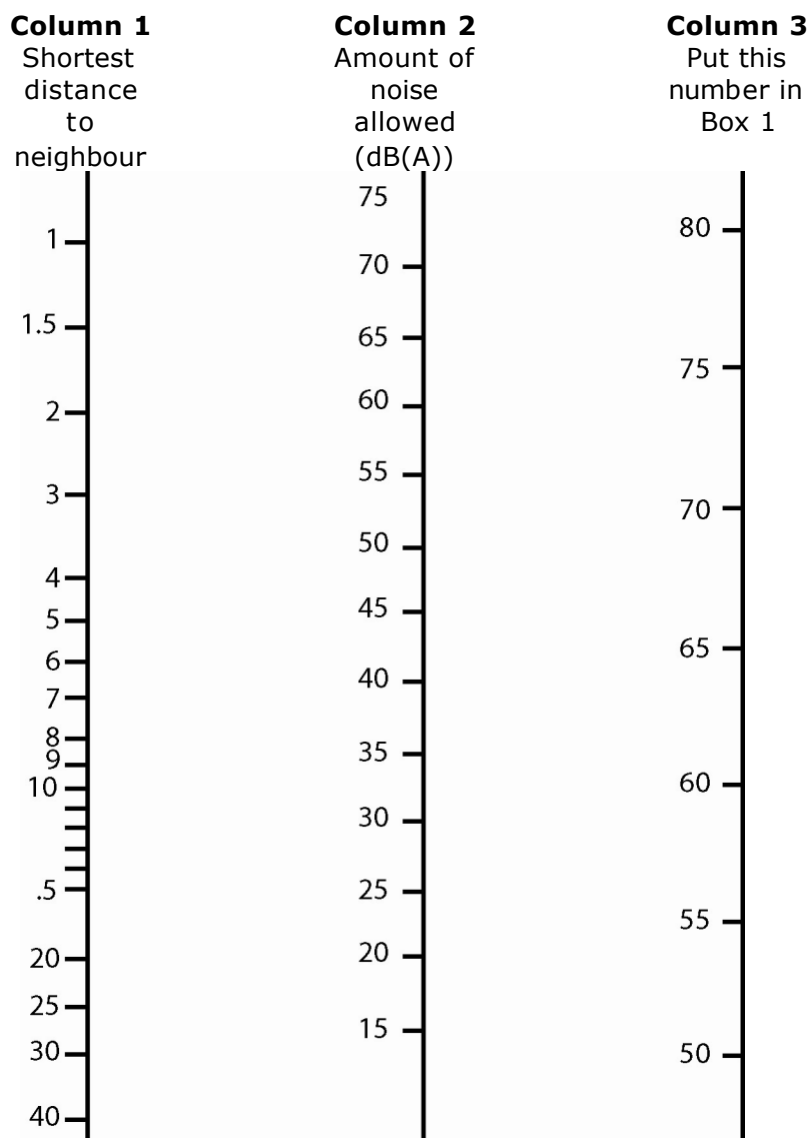
Yellow Pages

Website www.yellowpages.com.au
Look for See "Acoustical Consultants"

State Government

Website www.wa.gov.au
Look for Legislation. Also Acts, Regulations and Policies associated with environmental issues

Appendix 1 – Acoustic Nomogram



$$\begin{array}{ccccccc}
 \text{Distance} & & \text{Barrier} & & \text{Reflection} & & \text{Sound} \\
 \text{Factor} & + & \text{Factor} & - & \text{Factor} & = & \text{Power Level} \\
 & & & & & & \text{dB(A)} \\
 \boxed{\text{BOX 1}} & & \boxed{\text{BOX 2}} & & \boxed{\text{BOX 3}} & & \boxed{\text{ANSWER}} \\
 \begin{array}{cc} \acute{ı} & \grave{y} \end{array} & & \begin{array}{cc} \acute{ı} & \grave{y} \end{array} & & \begin{array}{cc} \acute{ı} & \grave{y} \end{array} & & \begin{array}{cc} \acute{ı} & \grave{y} \end{array}
 \end{array}$$

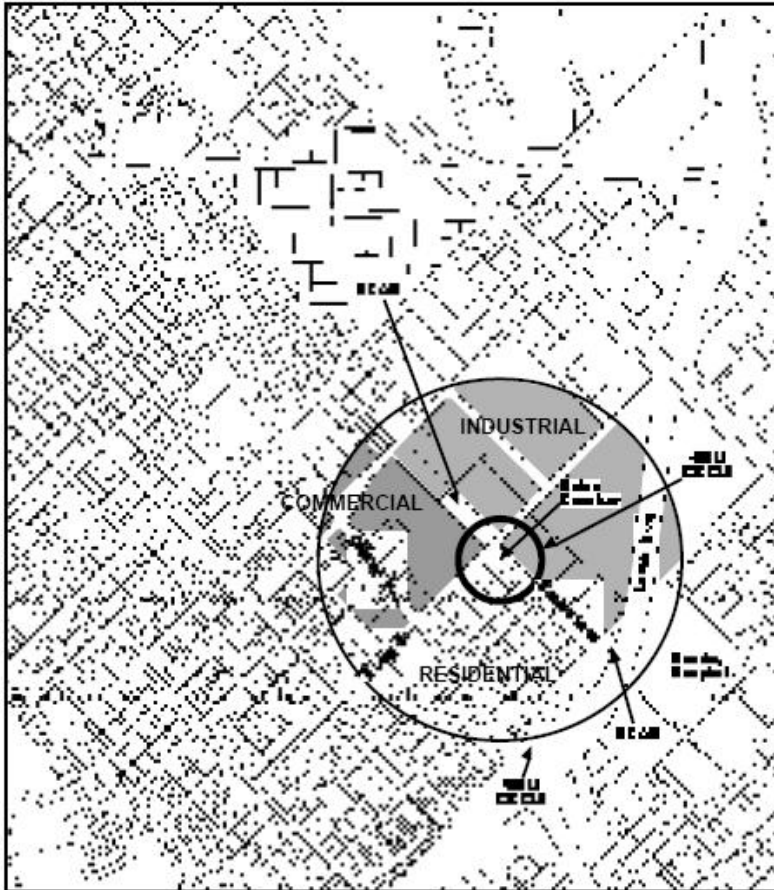
Appendix 2 – Worked Example of Influencing Factor and Assigned Levels

STEPS TO DETERMINE INFLUENCING FACTOR AND ASSIGNED LEVELS FOR A RESIDENTIAL PREMISES (illustrated in worked example below)

- Step 1** – Obtain a council zoning map covering an area up to 500 metres from the receiving point;
- Step 2** – Draw two circles around the receiving point, of 100 metres and 450 metres radius;
- Step 3** – Work out the percentage of each circle taken up by Industrial and Commercial zonings. Note that the industrial and commercial areas in the inner circle are also counted in the outer circle
- Step 4** – Add up the percentages as follows:
 $I = (\% \text{ industrial in small circle} + \% \text{ industrial in large circle}) \times 0.1$
 $C = (\% \text{ commercial in small circle} + \% \text{ commercial in large circle}) \times 0.05$
- Step 5** – Work out the Transport Factor as follows:
- Major road (>15,000 vehicles/day) in small circle, TF = 6
 - Major road in large circle, TF = 2
 - For each secondary road (6,000 – 15,000 vehicles/day in small circle, TF = 2
- Note: TF cannot be more than 6;
- Step 6** – Add I, C and TF from steps 4 and 5 to obtain the influencing factor;
- Step 7** – Now fill in the table of assigned levels by adding the Influencing Factor to obtain the LA10, LA1 and LMax assigned levels

SAMPLE CALCULATION OF ASSIGNED NOISE LEVELS FOR A RESIDENTIAL PREMISES

The receiving point is a residence at the corner of Ewing Street and Davies Lane, Bentley.



Steps 1 and 2 – Obtain a zoning map and draw two circles around the receiving point, of 100 metres radius and 450 metres radius.

Step 3 – Percentages of industrial and commercial zonings:

% industrial in small circle	= 20%
% industrial in large circle	= 34%
% commercial in small circle	= 15%
% commercial in large circle	= 16%

Note: Bentley Hospital is considered to be commercial land, as it has more than 150 beds. See Appendix 3 for lists of types of premises.

Step 4 – Add Percentages

$$\begin{aligned}
 I &= (\% \text{ industrial small circle} + \% \text{ industrial large circle}) \times 0.1 \\
 &= (20 + 34) \times 0.1 \\
 &= 5.4
 \end{aligned}$$

$$\begin{aligned}
C &= (\% \text{ commercial small circle} + \% \text{ commercial large circle}) \times 0.05 \\
&= (15 + 16) \times 0.05 \\
&= 1.5
\end{aligned}$$

Step 5 – Transport Factor

Albany Highway: 35,000 vehicles/day approximately
Leach Highway: 39,000 vehicles/day approximately

As there are major roads (>15,000 vehicles/day) in outer circle – TF = 2

Step 6 – Add I, C and TF to obtain Influencing Factor

$$\begin{aligned}
\text{Influencing Factor} &= I + C + \text{TF} \\
&= 5.4 + 1.5 + 2 \\
&= 9 \text{ (rounded to a full number)}
\end{aligned}$$

Step 7 – Fill in the table of assigned levels by adding nine to the L_{A10} , L_{A1} and L_{Amax} assigned levels

Time of day	Noise level (dB(A))		
	L_{A10}	L_{A1}	L_{Amax}
7am to 7pm Monday to Saturday	54 (45 + 9)	64 (55 + 9)	74 (65 + 9)
9am to 7pm Sunday and public holidays	49	59	74
7pm to 10pm all days	49	59	64
10pm on any day to 7am Monday to Saturday and 9am Sunday and public holidays	44	54	64

Appendix 3 – Definition of Types of Premises

Industrial and utility premises –

- premises used for providing water, electricity, communications, etc
- premises used by aircraft or ships, as a freight yard or for passenger transport
- industrial premises
- mine sites and quarries
- waste disposal sites
- offices, grounds and caretakers' residences which are part of the above

Commercial premises

- offices and retail shops
- premises in or from which meals or food are sold to the public
- service stations
- indoor amusement centres eg theatres
- outdoor amusement centres
- hotels which don't provide accommodation
- health centres
- hospitals with 150 beds or more
- centres for community meetings
- testing laboratories
- veterinary clinics, kennels and the like
- offices, grounds and caretakers' residences which are part of the above


Noise Sensitive Premises

- premises occupied solely or mainly for residential or accommodation purposes
- rural premises
- caravan parks and camping grounds
- hospitals with less than 150 beds
- rehabilitation centres, care institutions and the like
- educational institutions
- premises used for public worship
- hotels which provide accommodation to the public
- premises used for aged care or child care
- prisons and detention centres
- any other premises not referred to above under industrial and utility or commercial premises

Appendix 4 - Data Form

This Data Form is intended to record the basis for calculations used by the Supplier to estimate the air conditioner capacity for a particular customer. It should be used with the AIRAH Residential Air Conditioning Best Practice Guideline and it should be left with the customer on completion of the installation.

Customer Details	Name			
	Address			
	Address of Installation			
	Contact Details:		Phone:	
			Email:	
Date of Installation				
Type of building (eg Weatherboard, Brick etc.)				
Design Basis	Internal design temperatures	Summer	°CDB	°CWB
				Winter °CDB
	External design temperatures	Summer	°CDB	°CWB
				Winter °CDB
	Method used to calculate cooling load			
	Calculated cooling load	GTH (kW)	TSH (kW)	Air Flow (l/s)
Calculated heating load	GTH (kW)		Air Flow (l/s)	
Estimated system size				
Equipment Selection	System selection (make & model) at nominated design conditions	GTH (kW) TSH (kW)	Heating (kW) Air Flow (l/s)	
	(Other Comments)			
Outside Unit Sound Power Rating: dB(A)				
Calculated Outside Sound Pressure Level : dB(A)				

( detach here and leave with Customer)

Details of Room(s)	Room 1 & Name	
	Size of room (eg 10m ²)	
	Insulation (eg batts)	
	Primary aspect (eg North)	
	People & Equipment (eg 3 people, 1 kW)	
	External shading (eg none)	
	Windows A x B	
	Internal shading eg blinds	

Details of Room(s)	Room 2 & Name	
	Size of room (eg 10m ²)	
	Insulation (eg batts)	
	Primary aspect (eg North)	
	People & Equipment (eg 3 people, 1 kW)	
	External shading (eg none)	
	Windows A x B	
	Internal shading eg blinds	

Details of Room(s)	Room 3 & Name	
	Size of room (eg 10m ²)	
	Insulation (eg batts)	
	Primary aspect (eg North)	
	People & Equipment (eg 3 people, 1 kW)	
	External shading (eg none)	
	Windows A x B	
	Internal shading eg blinds	

Details of Room(s)	Room 4 & Name	
	Size of room (eg 10m ²)	
	Insulation (eg batts)	
	Primary aspect (eg North)	
	People & Equipment (eg 3 people, 1 kW)	
	External shading (eg none)	
	Windows A x B	
	Internal shading eg blinds	

✂ detach here and leave with Customer

Details of Room(s)	Room 5 & Name	
	Size of room (eg 10m ²)	
	Insulation (eg batts)	
	Primary aspect (eg North)	
	People & Equipment (eg 3 people, 1 kW)	
	External shading (eg none)	
	Windows A x B	
	Internal shading eg blinds	

Details of Room(s)	Room 6 & Name	
	Size of room (eg 10m ²)	
	Insulation (eg batts)	
	Primary aspect (eg North)	
	People & Equipment (eg 3 people, 1 kW)	
	External shading (eg none)	
	Windows A x B	
	Internal shading eg blinds	

Noise Calculation:

Distance Factor	+	Barrier Factor	-	Reflection Factor	=	Sound Power Level dB(A)
BOX 1		BOX 2		BOX 3		ANSWER
í ý		í ý		í ý		í ý

Company Contact:

Address:

.....Postcode:

Phone:Fax:

Installer Name:.....

Address:Postcode:

Phone:Fax:

Licence Number (if applicable):.....

Attach card or stamp