RESIDENTIAL AIR CONDITIONING DEVICES

PUBLICATION NPC-216

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MINISTRY OF ENVIRONMENT AND ENERGY

This Publication establishes sound level limits and sound emission standards for residential air conditioning devices.

This document replaces Technical Publication NPC-116 "Residential Air Conditioners" of the "Model Municipal Noise Control By-Law, Final Report, August 1978".

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Residential Air Conditioning Devices

1. Scope

This Publication sets sound level limits and sound emission standards for residential air conditioning devices including heat pumps installed in urban areas of Ontario.

2. References

Reference is made to the following publications, or revisions thereof:

[1] NPC-101 - Technical Definitions

[2] NPC-102 - Instrumentation

[3] NPC-103 - Procedures

[4] NPC-104 - Sound Level Adjustments

[6] NPC-206 - Sound Levels due to Road Traffic

[10] ORNAMENT, Ontario Road Noise Analysis Method for Environment and Transportation, Technical Document, Ontario Ministry of the Environment, ISBN 0-7729-6376 (1989).

[12] Survey of Outdoor Air Conditioner Noise, Final Report. RAC Report #458G, Ontario Ministry of the Environment, ISBN 0-7729-9094-8 (1991).

[13] Environmental Noise Guidelines for the Installation of Residential Air Conditioning Devices, Ontario Ministry of Environment and Energy, ISBN 0-7778-1616-4 (1994).

[14] ARI* Standard 270 - 84. Sound Rating of Outdoor Unitary Equipment.

[15] ARI* Standard 275 - 84. Application of Sound Rated Outdoor Unitary Equipment.

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* Air-Conditioning and Refrigeration Institute, 4301 North Fairfax Drive, Suite 425, Arlington, VA 22203

[16] ANSI Standard S12.32 - 1990. Discrete-Frequency and Narrow-Band Noise Sources in Reverberation Rooms, Precision Methods for the Determination of Sound Power Levels.

References [1] to [6] are also part of the
Model Municipal Noise Control By-Law, Ontario Ministry of the Environment.

3. Technical Definitions

"Ambient sound level"
is the sound level that is present in the environment, produced by noise sources other than the source under impact assessment. See Background sound level;

"Background sound level"
means Ambient sound level;

"Class 1 Area"
means an area with an acoustical environment typical of a major population centre, where the background noise is dominated by the urban hum.

"Class 2 Area"
means an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring only between 23:00 and 07:00 hours in Class 1 Areas, will typically be realized as early as 19:00 hours.

Other characteristics which may indicate the presence of a Class 2 Area include:

- absence of urban hum between 19:00 and 23:00 hours;
- ambient sound level is defined by natural environment and infrequent human activity; and
- no clearly audible sound from stationary sources* other than from those under consideration.

* In the context of this Publication, the stationary sources under consideration are residential air conditioning devices.

"Class 3 Area"

means an area with an acoustical environment that is dominated by natural sounds typical of agricultural or wilderness areas and having little or no road traffic, such as the following:

- a small community with less than 1000 population;
- farm land or land zoned rural or agricultural;
- a rural recreational area such as a cottage or a resort area; or
- a wilderness area.

4. Sound Level Limits for Air Conditioning Devices

Either the general sound level limit in Section 4.(1) or the specific sound level limit in Section 4.(3) shall apply to an air conditioning device. The less restrictive of these two limits shall prevail.

(1) General Sound Level Limit

The general sound level limit (shown in Table 216-1 and determined in accordance with Section 4.(2)) is 5 dBA greater than a one hour equivalent sound level (L_{eq}) caused by road traffic at the point of reception during the period of 07:00 to 21:00 hours. The specific hour is to be determined by the noise control officer based on the assessment of annoyance by the complainant.

TABLE 216-1
GENERAL SOUND LEVEL LIMIT

All Air Conditioning Devices	
Area Type	L_{eq} (dBA)
Class 1 and Class 2	One Hour Equivalent Sound Level (L_{eq}) of road traffic plus 5 dBA measured during the period of 07:00 to 21:00 hours

(2) Establishment of the General Sound Level Limit

The general sound level limit shall be established through measurements or calculation of the One Hour Equivalent Sound Level (L_{eq}) caused by road traffic as obtained pursuant to Reference [6] at the point of reception.

(3) Specific Sound Level Limits

Specific sound level limits are identified in Table 216-2 for two types of residential air conditioning devices as minimum limits of compliance.

TABLE 216-2
SPECIFIC SOUND LEVEL LIMITS

Central Air Conditioning Devices	
Area Type	One Hour L_{eq} (dBA)
Class 2	45
Class 1	50*
Window or Through-the-Wall Air Conditioning Devices	
Area Type	One Hour L_{eq} (dBA)
Class 2	45
Class 1	50

* When the devices are mandatory requirements for noise control in the interior living spaces of new land use developments, the specific sound level limit is one hour L_{eq} = 55 dBA.

5. Sound Levels from Installed Air Conditioning Devices

To determine if an installed air conditioning device complies with the sound level limits, the sound level due to the device must be measured following the procedure described in Reference [3].

The procedure assumes that the measured sound is dominated by the source under investigation (air conditioning device). To ensure that the measured sound is dominated by the air conditioning device, sound level measurements must be carried out separately with, and without the device in operation.

The measurement of the background sound level, i.e. without the air conditioning device operating, is carried out in accordance with the procedure described in Reference [3].

If the change in sound level measured separately with, and without the air conditioning device operating is less than 10 dBA, a correction shall be made to determine the contribution of the existing background sound levels to the overall measured sound level. Table 216-3 provides correction values and a example of the calculation.

TABLE 216-3
PROCEDURE RECOMMENDED TO SEPARATE THE SOUND LEVEL OF AN AIR CONDITIONING DEVICE FROM THE BACKGROUND SOUND LEVEL

Change in dBA of Sound Level With and Without Unit in Operation	Correction in dBA to Be Subtracted from Higher Sound Level to Obtain Sound Level from Device
10 or more	0
7 to 9	1
4 to 6	2
3	3
2	4
1	6
0	10

Example:

Sound level without unit in operation		**= 45 dBA**
Sound level with unit in operation		**= 50 dBA**
Change		**= 5 dBA**
Correction from Table		**= 2 dBA**
Unit sound level	**= 50 - 2**	**= 48 dBA**

6. Sound Emission Standards

Table 216-4 gives the sound emission standards for new residential central air conditioning devices.

TABLE 216-4
SOUND EMISSION STANDARDS FOR
RESIDENTIAL CENTRAL AIR CONDITIONING DEVICES

Date of Manufacture	Size (BTUH)	Maximum ARI Standard* Sound Rating (bels)
After 1990-12-31 and Before 1992-01-01	38,900 or less	8.0
After 1991-12-31 and Before 1995-01-01	38,900 or less	7.6
After 1994-12-31	38,900 or less	(Under discussion with the industry to assess the feasibility of reduction.)
BTUH = British Thermal Unit for an Hour		

Measurement procedure as per Reference [14].

ANNEX

EXPLANATORY NOTES TO PUBLICATION NPC-216 RESIDENTIAL AIR CONDITIONING DEVICES

A.1. Sound Level Measurements - Summary

Verification of compliance of the air conditioner and heat pump units with the sound level limits can be accomplished through measurements using a properly calibrated sound level meter which meets the required standard specifications.

Details of the instrument specifications are included in Reference [2].

The measurements shall be performed outdoors at a sensitive location on neighbouring residential property in the vicinity of the air conditioning device, where the sound of the device may cause annoyance. Typically this would be a patio or a window.

The measurements may also be required at a point of reception in the plane of an open window facing the unit to ensure that the sound level at noise sensitive indoor spaces in a neighbouring residence is not in excess of the guideline limits. Details of the measurement procedure are included in Reference [3].

A.2. Sound Level Limits

People's response to noise varies depending upon the community's, as well as the individual's economic and social relationship to the source. The sound level limits for air conditioner and heat pump noise were established based on the results of sociological surveys of large numbers of people and represent what is considered to be the onset of significant degradation of the noise environment relative to the expectations of the general population.

The sound level limits are receptor oriented, i.e. they apply at any noise sensitive location within a Class 2 or Class 1 Area (as defined in NPC-216) at which sound from the air conditioning device may cause annoyance.

The specific limits shown in Table 216-2 are expressed in terms of the one hour equivalent sound level L_{eq}, and apply to receptor locations in Class 1 and Class 2 Areas.

A separate limit applies to those receptor locations in Class 1 Areas where the unit was a mandatory requirement for noise control of the interior living space in new land use developments.

A preemption in the form of a general limit applies in an area of a relatively high background noise caused by road traffic as shown in Table 216-1. In accordance with this pre-emption, the existing background sound level, if higher than the limits in Table 216-2, represents the criterion of acceptability for the air conditioning device operation. In addition, the general limits are increased by 5 dBA for any hour from 07:00 to 21:00 hours. The period of assessment was chosen in accordance with the findings of a sociological survey conducted in 1990, Reference [12].

A.3. Complaint Investigation

Investigators of a complaint against installed air conditioning devices must carry out sound level measurements at the receptor location(s). The measurements are to be made in accordance with methods identified in Section A.1. The operating sound of the air conditioning device and the background sound consisting of the road traffic noise must be measured at the same location, separately. While the background sound level is measured the air conditioning device must be turned off. Contributions from aircraft and rail noise sources must be inhibited at all times. Unattended measurements are not recommended. Atmospheric conditions may have significant influence on the ambient sound levels, for details see Reference [3].

The sound level of an installed air conditioning device may be calculated from the sound levels measured with the device operating (device plus background noise) and without it operating (background only). The procedure is described in Section 5. A correction value is determined between these two sound levels. Subtracting this correction from the higher sound level (measured with the device in operation) gives the sound level due to the air conditioning device itself. See Table 216-3.

Determination of the road traffic sound level is to be made by the noise control officer based on the assessment of the annoyance by the complainant(s). The time of highest annoyance within the time period of 07:00 to 21:00 is to fall in the selected one hour of the road traffic noise.

A.4. Installation of Air Conditioning Devices

Purchasers and installers of air conditioning devices have to be cognizant of the MOEE guideline on the Sound Emission Standards listed in Table 216-4. Further explanation of the standards is provided in Section A.5. Only units meeting the requirements of Table 216-4 may be installed in Ontario.

For guidance on the selection, location or sound rating of the air conditioning devices or for the method to estimate the sound levels, installers should refer to Reference [13].

Installation of units that are in compliance with the sound emission standard must also be in compliance with the point of reception sound level limits, i.e. complying with the least restrictive sound level limit of Tables 216-1 and 216-2.

If the calculated sound level of the unit is in excess of the specific sound level limit (Table 216-2), the general sound level limit is to be determined. If both limits are exceeded by the calculated levels then alteration is needed in one or more of the following: the size or make of unit, its location or the type of noise reducing installation treatment (use of barrier or enclosure).

Owners of installed units producing a sound level in excess of the sound level limits will be required to reduce the noise of the unit, when faced with complaints.

Noise abatement is more expensive and less cost effective than a proper installation.

A.5. Sound Emission Standards

In contrast to the sound level limits which apply at the point of reception, sound emission standards are source oriented, and are based on the concept of sound power level which is a basic measure of the acoustic output of a noise source.

The sound level of the air conditioner or heat pump at a receptor location depends on many factors such as distance separation, unit's orientation with respect to the receptor, presence of shielding objects or structures, intervening terrain, topography and ground cover between the unit and receptor, as well as on atmospheric conditions, all of which are independent of the actual sound emission of the unit.

Sound power on the other hand is a fundamental property of the acoustic source alone and is, therefore, an important absolute parameter which is widely used for rating and comparing sound sources.

The rating of air conditioner and heat pump equipment is designated as the ARI Sound Rating (SR*) and is provided by the manufacturer of the device.

The Sound Rating is based on laboratory tests performed at Standard Rating Conditions in accordance with References [14] and [16]. The SR is an indicator of the sound power level of the equipment; the lower the SR, the lower the sound power of the air conditioner or heat pump.

Sound Emission Standards in Table 216-4 apply to central air conditioning devices only and not for window or through-the-wall units.

The maximum acceptable ARI Standard Sound Ratings shown in Table 216-4 are set in accordance with the date of manufacture. Two Sound Emission Standards, 8.0 and 7.6 bels are specified for air conditioner and heat pump units manufactured during 1991, and during 1992 through 1994 respectively. The Sound Emission Standard applies to units that are sized at 38,900 BTUH capacity or less. The emission limits projected after 1994 are under discussion with the industry to assess the feasibility of reduction.

SR is a tone corrected A-weighted sound power level, expressed in bels.