



The Air-Conditioning and Refrigeration Institute (ARI) is a voluntary, nonprofit organization comprised of the manufacturers of air conditioning, refrigeration, and heating products. More than 90% of the air conditioning and refrigeration machinery and components manufactured in the U. S. is produced by members of ARI.

Two of ARI's most important functions are the development of performance rating standards and the administration of these programs for the eligible products. Participation in the program is voluntary. ARI regularly selects random samples of equipment to be tested by an independent laboratory under contract to ARI. The equipment is tested using procedures stipulated in the corresponding ARI Standards to verify that it meets the manufacturer's certified published performance ratings.

ARI is an independent lab that monitors SOUND and AIR PERFORMANCE. A label is attached to each unit at the time of shipment. Also, this label is included with the catalog specification data.

Carnes VAV units are certified with ARI Standard 880-2008 for air terminals which provide industry agreed-upon methods for determining sound power ratings of air terminals.

NC vs SOUND POWER

Many engineers prefer that the sound performance be based on noise criteria (NC) rather than decibels. Carnes provides this information in both forms. The associated sound power values are plotted on an NC chart and the resulting values are cataloged for the convenience of our customers. 125 Hz through 4000 Hz (bands 2 to 7) are plotted, and the highest NC value obtained is shown in the catalog. Distinct frequencies have different human annoyance levels, for example: 45 db sound power value is an unacceptable human noise level in some frequency bands, but it is an acceptable level in other bands. This NC value provides the engineer a quick reference to the highest sound a particular VAV unit will generate across all bands. See Table 2 for application of typical NC values.

SOUND REDUCTION TECHNIQUES

The Carnes Company supplies equipment for VAV systems that can be utilized in a variety of applications. The following recommendations for selection and installation have proven to be effective in minimizing the unwanted sound that VAV products can generate.

1. Locating terminal units over hallways, unoccupied spaces, or spaces with relatively high background noise, will greatly minimize perceptible VAV sound.
2. Terminal unit sizing should be selected to keep the maximum velocity below 3000 FPM and still maintain enough air flow to ensure the unit will control at minimum air flow. **CAUTION:** Oversizing the unit (lowering the minimum velocity below 365 FPM) may result in loss of control for **pressure independent applications.**
3. Smooth 90 degree elbows and lengthening the downstream duct can dramatically reduce unwanted discharge sound. Additional pressure losses may occur with this technique.
4. Downstream sound attenuators and sound traps will reduce discharge noise in some octave bands.
5. Lower static pressure will reduce the amount of air turbulence in the ductwork. This results in reducing both discharge and radiated noise.

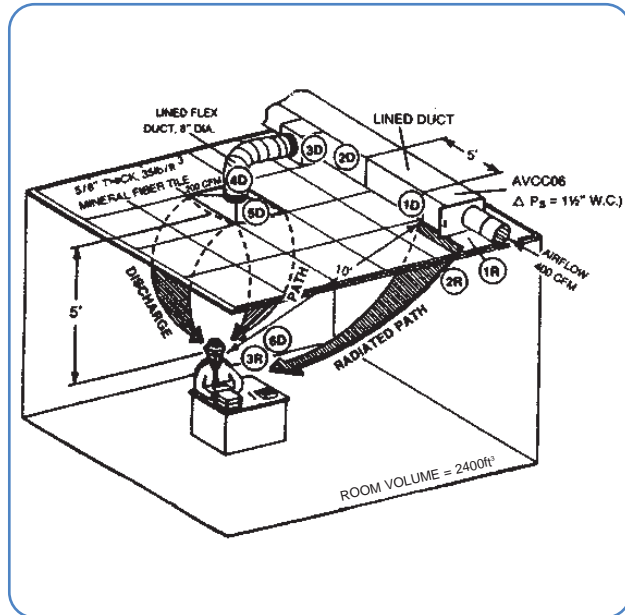
Criteria for Acceptable HVAC Noise Levels in Unoccupied Rooms

Table 2

Type of Installation	Level
Private residences	.NC 25-30
Apartments	.NC 30-35
Hotels/Motels	
Individual rooms or suites	.NC 30-35
Meeting/banquet rooms	.NC 30-35
Hall, or corridors, lobbies	.NC 35-40
Service/support areas	.NC 40-55
Offices	
Executive	.NC 25-30
Conference rooms	.NC 25-30
Private	.NC 30-35
Open-plan areas	.NC 35-40
Business machines/computers	.NC 40-45
Public circulation	.NC 40-45
Hospitals and clinics	
Private rooms	.NC 25-30
Wards	.NC 30-35
Operating rooms	.NC 25-30
Laboratories	.NC 35-40
Public areas	.NC 35-40
Churches	.NC 30-35
Schools	
Lecture and classrooms	.NC 25-30
Open-plan classrooms	.NC 35-40
Libraries	.NC 35-40
Courtrooms	.NC 35-40
Legitimate theaters	.NC 20-35
Movie theaters	.NC 30-35
Restaurants	.NC 40-45
Concert and recital halls	.NC 15-20
Recording studios	.NC 15-20
TV studios	.NC 20-25

1991 Applications Handbook (ASHRAE)

ARI Standard 885-2008 is the industry-accepted method for estimating sound pressure levels in a conditioned, occupied space. The sound levels addressed in this standard include most, but not all, sound sources in the air distribution system. The example below is a summary of the sound estimates used



in this catalog to assist the designer when making component selections. This example takes the air terminal sound power values (discharge and radiated) and makes the appropriate corrections defined by the standard.

DISCHARGE SOUND PATH

Table 3

Octave Band	2	3	4	5	6	7
1D AVCC 06 Discharge Sound ΔPs = 1-1/2" Flow = 400 CFM	65	63	61	61	57	52
2D *5' Lined Duct (1" Fiberglass)	-2	-4	-10	-20	-20	-14
3D **Flow Division	-3	-3	-3	-3	-3	-3
4D 5' Flex Duct (8" Diameter)	-5	-10	-18	-19	-21	-12
5D End Reflection	-10	-5	-2	-1	0	0
5D Space Effect Factor (2400 ft³ 5' to receiver)	-5	-6	-7	-8	-9	-10
5D Environmental Adjust. Factor	-2	-1	0	0	0	0
Total Attenuation Deductions	-27	-29	-40	-51	-53	-39
6D Discharge Sound at Receiver Location	38	34	21	10	4	13

RADIATED SOUND PATH

Table 4

Octave Band	2	3	4	5	6	7
1R AVCC 06 Discharge Sound ΔPs = 1-1/2" Flow = 400 CFM	59	55	50	46	46	43
2R Plenum/Ceiling Effect (Mineral Tile)	-16	-18	-20	-26	-31	-36
3R Environmental Adjust. Factor	-2	-1	0	0	0	0
Total Attenuation Deductions	-18	-19	-20	-26	-31	-36
Radiated Sound at Receiver Location	41	36	30	20	15	7

* <300 CFM	5' Lined Duct (1" Fiberglass)	-2	-6	-12	-25	-29	-18
300-700 CFM	5' Lined Duct (1" Fiberglass)	-2	-4	-10	-20	-20	-14
>700 CFM	5' Lined Duct (1" Fiberglass)	-2	-3	-9	-18	-17	-12
** <300 CFM	Flow Division	0	0	0	0	0	0
300-700 CFM	Flow Division	-3	-3	-3	-3	-3	-3
>700 CFM	Flow Division	-5	-5	-5	-5	-5	-5



A Participating Member
in the ARI 880
Certification Program

Carnes provides ARI Certified Air Terminals to ensure that the customer receives units that perform to printed catalog data for sound and performance. An ARI label is attached at time of shipment.