

An Assessment of Wine Room Air Conditioner Units for Noise and Cooling capacity

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Wine enthusiasts store and age fine wines and have special requirements that are not often satisfied by typical air-conditioning equipment. Commercially available air conditioners are provided by a number of manufacturers to control the internal environments of a wine storage rooms. A variety of designs are available for the consumers to select. This report is a summary of an assessment performed on five different wine room air conditioning units. Tests were performed to assess noise levels inside and outside the test room, the air flow on both sides of each unit and the cooling capacity for each unit under tightly controlled conditions. The units tested included two units from Air Innovations - Wine Guardian Models TTW018 and TTW009, two units from WhisperKOOL models - 4200 and 8000, and one unit from Breezaire.

The testing was performed at Clarkson University during the spring of 2010. All five units were tested under the same environmental conditions which included a simulated wine room inside temperature of 58 \pm 1 F, relative humidity of 54 \pm 1 % RH and outside room temperature of 75 \pm 2 F. There was no criterion for relative humidity for the outside room position, yet remained ~30% throughout the series of tests.

Study findings:

1. The Wine Guardian units were the most energy efficient units of all of the units tested when run in the continuous cooling mode.
2. Wine Guardian units produced lower noise levels by greater than 4 db(A).
3. The cooling capacity of the Wine Guardian units was found to be similar to the WhisperKOOL units of comparable size. However, the Whisper KOOL units were found to use significantly more (> 50%) energy during cooling.

Evaluation conditions and Experimental Set-up

All Units were tested in an 8'x12'x7' room. The room was cooled to the target temperature of 58 F with a window air conditioning unit. Humidity was controlled to 54% RH with a humidification unit designed for homes. The capacity of the room air conditioning unit and humidification unit were significantly over sized for the test room, yet this allowed for the relatively quick adjustment of the room conditions to the target temperature and humidity levels for testing each unit. The units tested included:

Wine Guardian Models TTW018 and TTW009
Manufactured by **Air Innovations**



WhisperKOOL Models, Manufactured by **Vinotheque**
Models: 4200 (~1000 ft³ maximum room size) and 8000 (~2000ft³ maximum room size)



Breezaire, by Breezaire Products Company
Model WKL 4000 for a ~1000 ft³ room



All units tested were through-the-wall type designs. Each unit was mounted into a 2 x 2 foot opening in a wall of a room with the following dimensions, 12 x 8 x 7 feet for each test. Insulation was packed around the unit to ensure the air was not transferred from the inside of the room to the outside of the room. Upon completion of the test, the unit was removed from 2 x 2 foot opening and the next wine room air conditioning unit was installed in the same location. The room was allowed to reach the 58/54 target values and the tests were completed.

The following data was collected for both the intake and supply for both inside the room and outside of the room: Air flow (ft³/min), Dry bulb temperature (F), Relative humidity (%RH), and noise levels (dB(A)). The air flow measurements were taken with an ALNOR Balometer hood. This device measured the volumetric flow rate of air from both the supply and return section of the unit. Special templates were developed to fit the Balometer to each unit and ensure the air flow was collected only from the section of the air conditioning unit of interest. Essentially the templates segmented the return air from the supply air and allowed for an accurate measure of the air flowing into the unit versus out of the unit. Finally, a meter was connected to each unit during the continuous cooling to determine the energy use in watts.

A Fluke 975 Air Meter (Fluke Corporation) was used to measure the dry bulb temperature and relative humidity. The noise levels were measured with a Quest 2800 sound level meter (Quest Technologies) and air flow measurements were collected with an ALNOR Model - LoFlo Balometer 6200F. Calibration certification (# 70715255) by TSI incorporated. All measurements were collected in spring and summer of 2010.

Findings:

Detailed data tables and diagrams of the units are displayed in Appendix A. A summary is provided in Table I.

The noise levels were taken at distances from 1 to 4 feet on the outside section of the unit. The levels at four feet ranged from a low of 56.4 dB(A) for the TTW009 Wine Guardian unit to a high of 61.1 dB(A) for the Breezaire unit. Noise levels are expressed in a log scale [Sound pressure levels (SPL = 20 Log(P/Po)], thus the difference in noise levels between the high and low unit varied by almost 5 fold.

The cooling capacity was calculated using the difference between the intake enthalpy and supply enthalpy multiplied by the air flow and corrected to the appropriate units. The cooling capacity ranged from a low of 757 to a peak of 2972 Btu/hr. However, the units were rated for different size rooms, thus the variability was expected. The units sized for larger rooms, TTW018, WhisperKool 8000 and the Breezaire were found to produce a similar cooling capacity, 2165, 2972 and 2315Btu/hr. However, a watt meter used to measure the energy consumption displayed during peak cooling showed significantly lower consumption values for both Wine Guardian units as compared to the other units of similar size, suggesting that the Wine Guardian units will have a better cooling capacity per unit energy consumed.

Table I. Summary Data of the Wine Room Air Conditioning Units

Wine Room Units	Noise @ 4' (dBA)	Supply (Ft³/min)	Cooling Capacity (Btu/hr)	Energy (Watts)
Wine Guardian TTW009	57.3	99	1007	288
Wine Guardian TTW018	56.4	147	2163	358
WhisperKOOL 4200	61	130	1112	473
WhisperKOOL 8000	59.3	337	2972	677
Breezaire WKL 4000	61	166	2316	608

Delivered voltage 112.3v

The attached spread sheets show all the data for each unit. The temperature and RH measurements are quite constant. The air flow measurements were taken from the return air side for all the units. Measurements were repeated several times to ensure the flow rate was constant. In summary, the Wine Guardian units operate at the lowest noise levels and maximize cooling at in the most energy efficient manner.