CAN THE AQT-2000 BE USED TO REDUCE FRESH AIR INTAKE BELOW 15 CFM PER STUDENT AND STILL MEET THE REQUIREMENTS OF ASHRAE 62-89?

The purpose of ASHRAE 62-89 is : ***"To specify minimum ventilation rates and indoor air quality that will be acceptable to human occupants and are intended to minimize the potential for adverse health effects."***

All codes and standards can be expressed in both the letter of the code/standard and the spirit of the code/standard. When a designer or Authority Having Jurisdiction (AHJ) follows the letter of the code or standard, strict procedures or specifications are followed as written in the code/standard. If the designer or (AHJ) does not strictly follow the letter of the code or standard but uses a method, procedure, equipment or specification with an end result which is the same as the requirements of the code or standard, they are said to be following the "spirit" or "intent" of the code or standard.

The intent of ASHRAE 62-89 is to provide indoor air quality, acceptable to human occupants, thus minimizing the potential for adverse health effects. The following will demonstrate that the use of an AQT-2000 in classroom ventilators can meet both the letter and spirit of ASHRAE 62-89.

ASHRAE 62-89 is broken into two classifications **4.1 Ventilation Rate Procedure** that is spelled out in 6.1. And, **4.2 Indoor Air Quality Procedure** detailed in 6.2.

6.1 establishes the parameters for acceptable outdoor air to be used for ventilation and lists the minimum outdoor air requirements for ventilation based on the type of occupancy. This is the simplest procedure and Table 2 in this section is where the 15cfm per student is dictated. When using 6.1 ventilation rates can not be reduced below 15cfm except in conformance 6.1.3.4.

6.2 is more complicated. It requires additional steps and documented calculations to demonstrate that air contaminants of indoor origin are kept within the allowable limits listed in Table 3, and not allowing other contaminants listed in Table 1 to rise above the EPA limits for outdoor air. If calculations and documentation can support it, 6.2 allows the outside air to be reduced below the 15cfm per occupant.

A closer look at Table 2 shows that classrooms have a recommended density of occupants of 50 students per 1000 sq.ft and a ventilation rate of 15cfm per student. This would mean a classroom would require 750cfm of outside air. It should be recognized that "classroom" could mean a kindergarten class of 20 students or a college lecture hall that seats 500.

ASHRAE 62-89 recognizes this by stating ***"When occupant density differs from that in Table 2, use the per occupant ventilation rate for the anticipated occupancy load".*** Thus when state law, teacher contracts or school board policy limits class size to 30 or 25 students per class, the designer should establish ventilation rates of 450cfm or 375cfm. Designers who mistakenly insist on the 750cfm per class requirement of ASHRAE 62-89 are doing their client a disservice by over ventilating, which in turn requires oversized heating and cooling equipment and excessive fuel costs.

Schools by their nature have intermittent and variable occupancies. Grade schools with recesses, lunch breaks, special education and tuition, field trips, gym class, library time music class and assemblies have students in and out of their classroom all day. Middle and high schools are equally as fluid with classes and class sizes changing every 40 minutes and some classrooms empty for some periods.

ASHRAE 62.89 recognizes the special nature of such occupancies in **6.1.3.4 Intermittent or variable occupancy.** This section in part states: ***"Ventilating systems for spaces with intermittent or variable occupancy may have their outdoor air quantity adjusted by use of dampers or by stopping and starting the fan system to provide sufficient dilution to maintain contaminant concentrations within acceptable levels at all times." It goes on: "Where peak occupancies of less than three hours duration occur, the outdoor air flow rate may be determined on the basis of average occupancy for buildings for the duration of operation of the system."***

Interpretation IC 62-1989-15 of ANSI/ASHRAE 62-89 covers this part of the standard. The question arose from typical schedules for elementary, middle and high schools in the Gwinnett County Georgia Public Schools. The schedules indicate that on a typical day the HVAC systems run 510 minutes and during that time the classroom is occupied 250 minutes or 49% of the time. The elementary school schedule indicates occupancy 44% of the time.

The interpretation committee agreed with the petitioner that using this occupancy rate and the variable occupancy rule, ***"the outside air to a typical classroom can be reduced to a level required by the average occupancy of the space, which in this example is half the peak occupancy."***

Assuming that the peak occupancy is 30 students, then the 450 cfm of air can be reduced to 225 cfm of continuous fresh air.

Using the AQT-2000 the clean air output (minimum fresh air) can be set at 225cfm and will automatically increase to 450 cfm or more as needed, thus meeting the letter of the code as interpreted in IC 62-1989-15. And meeting the requirement of 5.4 which reads: ***"When the supply of air is reduced during times when the space is occupied, provision shall be made to maintain acceptable indoor air quality throughout the occupied zone."***

In meeting the "spirit" of the code we must go beyond the simplicity of 6.1 and borrow from **6.2.1 Quantitative Evaluation.** Which states in part ***"In recent years a number of indoor contaminants have received increased attention and emphasis. Some of these contaminants, such as formaldehyde or other vapor phase organic compounds, are generated by the building, its contents and its site. Another important group of contaminants is produced by unvented indoor combustion. The presence and use of consumer and hobby products as well as cleaning and maintenance products, introduce a range of largely episodic releases of contaminants to the indoor environment. There are also complex mixtures, such as environmental tobacco smoke, infectious and allergenic biologic aerosols, emanations from human bodies, and emanations from food preparations."***

To review the information given in the quotation above, the AQT-2000 will react to and increase ventilation when it senses, formaldehyde or other vapor phase organic compounds (VOC's). Unvented indoor combustion would trigger a response from the AQT-2000 but unvented heating products are not acceptable for use in schools. Consumer and hobby products used in schools could include glues, paint and magic markers to which the AQT-2000 will react. In addition, most commonly used waxes, wax strippers and cleaning solvents used by a school maintenance staff cause the AQT-2000 to increase ventilation.

Environmental tobacco smoke is typically not an issue in schools, but in other applications the AQT-2000 will increase ventilation to compensate for tobacco smoke. Infectious biologic aerosols are presumably those given off by occupants with the flu, a cold or other illness. While the AQT-2000 cannot recognize a specific cold or flu virus it will react to the presence of humans by registering the biological aerosols given off as normal exhalation. In this manner, the AQT-2000 will increase ventilation as occupancy increases and decrease ventilation as occupancy decreases. Allergenic biologic aerosols in schools are most commonly associated with molds or mildew which offgas these biologic aerosols as VOC's, to which the AQT-2000 will react. Emanations from human bodies and food preparations will both cause an increase of ventilation when controlled by an AQT-2000.

The 6.2 procedure of the standard requires a quantitative evaluation with documented calculations to demonstrate that air contaminants are maintained within allowable limits.

But the use of an AQT-2000 can meet the spirit of 6.2 by automatically increasing ventilation to compensate for elevations in the indoor contaminants as shown above.

In conclusion the AQT-2000 when used as a demand control for ventilation in a class room unit ventilator, can reduce the ventilation rate below 15cfm per student and still meet both the letter and spirit of 62.89. The proof of the AQT-2000 is in its eight year history as a ventilation controller in schools. In addition the California energy commission recognizes the use of VOC controllers for use as an energy saving device to provide on demand ventilation.