HVAC DESIGN CRITERIA

General Standards

A. The heating, ventilating, and air conditioning system design standards criteria denoted as a part of this Design Manual have been developed or are obtained directly from accepted engineering design references such as the ASHRAE handbooks and standards, the state of Arkansas code references, and good engineering practice. School HVAC system plans and specifications shall be prepared by a licensed professional engineer with a valid Arkansas registration. The HVAC Design Professional should review each requirement and obtain or develop the necessary information for each specific building before proceeding with the systems design.

B. All systems shall be designed in compliance with ASHRAE Standard 90.1 "Energy Standard for Buildings except Low-Rise Residential Buildings", as modified by the Arkansas Energy Code.

C. All HVAC products shall be rated in accordance with the applicable ARI rating program (where rating has been established). or products manufactured in compliance with policies of the Arkansas HVACR Licensing Board and in compliance with Arkansas Law.

D. All new construction shall include air-conditioning except in some physical education and indoor practice facility spaces as hereinafter defined. Variances will be considered by the Division upon request.

System Selection Life Cycle Cost Analysis Guidelines

A. Several HVAC systems are applicable to Arkansas Schools. System selection shall be based on a life cycle cost analysis of a minimum of three alternative systems. This requirement for System Selection Life Cycle Cost Analysis applies to New Construction, including new buildings and additions to existing buildings, and the replacement to upgrade HVAC units in existing buildings when the cumulative cooling tonnage exceeds 16 tons. The Life Cycle Cost Analyses shall be submitted with the project final review documents. This analysis may be considered as an extra service to the design contract.

B. The following are examples of acceptable programs for use in generating a detailed evaluation of proposed heating, ventilating, and air conditioning systems. Further, the building load calculations necessary for the design of each building will require the use of computer-generated data. Equivalent computer programs that are able to generate the necessary data for evaluation of the proposed heating, ventilating, and air conditioning systems and for generation of the building load data will be considered, but must be submitted for approval prior to use.

1. Trane Trace 700 (or the most recent version of Trane Trace).
   a. The Trane Trace 700 program is a PC based program used by the HVAC Design Professional for generation of detailed building system air conditioning loads, energy consumption analysis, and economic analysis. The current version can be obtained from the Trane Company, Customer Direct Service (CDS) Network, La Crosse, WI, (608) 787-2000.

2. Carrier HAP (Or the most recent version of Carrier HAP).
   a. The Carrier Hourly Analysis Program is a PC based program used by the HVAC Design Professional for generation of detailed building system air conditioning loads, energy consumption analysis, and economic analysis. The current version can be obtained by contacting the local Carrier equipment representative or by calling Software Systems Network, Syracuse, NY, (315) 432-7072.
3. DOE-2.E
   a. The DOE-2.E is a detailed energy analysis program developed through the United States Department of Energy. A number of vendors across the country have developed software that operates to meet the intent of the DOE-2.E program.

C. Occupancy loads and schedules will mirror the building usage schedules. Input occupancy shall be calculated at 90 percent of capacity during normal school hours for classroom areas and the administration area. After hours occupancy can be considered negligible in these areas. Activity areas such as gymnasiums should be calculated at no more than 25 percent of the full load capacity during unoccupied operation.

D. Lighting systems shall be consistent throughout the building. The lighting load shall be input for consideration as a cooling load only, and should not be used to credit the winter heating load. Lighting loads shall comply with the Arkansas Energy Code. The HVAC Design Professional shall coordinate and review proposed lighting requirements for each building with the Electrical Design Professional prior to generating a final energy load analysis. Usage of the lighting systems should mirror the occupancy scheduling for each area in the building.

E. Computer locations and expected usage will impact every building designed. All classroom areas will be wired for computers. Include a minimum of 280 watts for each computer station in the building. This load includes the total expected heat gain for a desktop computer and color monitor.

Outdoor Air Design Values Guidelines

A. Summer and winter outside air design values shall be derived from standard ASHRAE compiled weather data located in the latest edition of the ASHRAE Fundamentals Handbook. The city nearest the proposed construction project is to be selected for evaluation. Use the 99.6 percent design values for heating design dry-bulb and the 1 percent design values for cooling design dry-bulb and mean coincidental wet-bulb. To determine the maximum ventilation capacity, use the 1 percent design values for Humidification design dew point and mean coincident dry bulb.

Indoor Air Design Values Guidelines

A. Indoor air temperature design values must reflect the need for energy conservation and shall be in accordance with the Arkansas Mechanical Code and the Arkansas Energy Code.

B. Design shall produce indoor conditions in accordance with ASHRAE Standard 55 “Thermal Environmental Conditions for Human Occupancy”.

C. Night setback controls shall be used for all systems. Winter setback temperature shall be 55 degrees Fahrenheit. The summer setup temperature shall operate as required to maintain a relative humidity in the building area that does not exceed 60 percent. Maintaining humidity levels below 60 percent will result in the periodic operation of the HVAC system during the summer months to reduce the potential for mold and mildew in the building.

Outdoor Air Ventilation Requirements Standards

A. Outdoor ventilation rates shall be calculated for each occupied space and shall conform to the requirements of the Arkansas Mechanical Code minimum ventilation rates. The only exception will be an engineered ventilation system design with written approval of exception by the Arkansas HVACR Board.

B. **Each system shall include controls for a 100 percent economizer cycle to cool the building when dictated by the Arkansas Energy Code.**

C. Energy recovery shall be used as a part of the design for classroom, gymnasium, locker room, and student dining systems to reduce the energy consumption required to provide the necessary outdoor ventilation rates when required by the Arkansas Energy Code.

D. Carbon dioxide levels may be monitored through the direct digital temperature control system for proof of system operation to maintain a carbon dioxide level in the building as recommended by ASHRAE Standard 62. The use of space specific carbon dioxide sensors are recommended for this operation. Return air sensors may be considered when a unit serves multiple spaces provided accurate readings can be obtained. It is not the intention of this guideline to require the use of carbon dioxide sensors for a reduction of outside air quantities below the calculated minimum air flow requirements.

E. Ventilation air <u>MUST</u> be conditioned for temperature and humidity control. Acceptable methods are dedicated OSA units, energy recovery ventilators, hot gas humidity control in packaged units and OSA conditioned in an air handling system.

Temperature Control Systems

A. All temperature control systems installed shall be electronic, direct digital controls. Pneumatic control systems will not be permitted. Each facility will be provided with the means to access the control system software with a desktop or laptop computer. It will be necessary for the HVAC Design Professional to advise the school district of the options for control and management of the building available through the direct digital control system. Building additions where less than 50% of the square footage is being added to a school campus without a DDC system may ~~use electronic night set back~~ <u>7-day programmable</u> thermostats.

B. Thermostatic zoning shall be developed using good engineering practice. Dissimilar spaces shall not be grouped on the same thermostat. Each classroom shall be an independent zone. Other zones may also be required to be separately thermostatically controlled. Carefully review space requirements for these

requirements. Occupied/unoccupied scheduling shall be based on the associated air handling system. Each thermostat zone associated with digital control shall have a means to override the schedule for temporary occupancy.

C. The direct digital control system shall be capable of performing time of day scheduling, night set-back, holiday scheduling and demand limiting.

D. The ventilation system control shall be set through the central direct digital controller based on global outside air temperature and humidity to maintain indoor relative humidity below 60 percent.

E. The direct digital control system shall be designed to place emergency calls to designated school personnel in the event of equipment failure.

F. Options shall be investigated with each direct digital control system for the operation of exterior, corridor, and restroom lighting systems through the energy management computer.

G. Classrooms and other instructional spaces shall be ducted supply to at least four (4) supply air devices.

Interior and Exterior Noise Control Guidelines

A. Interior HVAC acoustic design shall not cause indoor sound levels to exceed NC30. ~~Classrooms and other instructional spaces shall be ducted supply to at least four (4) supply air devices.~~

B. The location of exterior mechanical equipment shall be reviewed by the Design Professional for its sound impact, both inside and outside the building.

C. Exterior equipment operation shall not cause indoor sound levels to exceed specified levels for the space.

D. Exterior sound levels shall be in compliance with the local governmental ordinances. When these values are not governed, the sound level created by the equipment shall not exceed 70 dB measured at the property line.

Equipment Accessibility Standard

A. Access and service space per mechanical equipment shall be in accordance with the Arkansas Mechanical Code.

Closeout Documents Guidelines

A. O & M Manuals shall be provided in duplicate for the School District. Manuals shall contain approved shop drawings, operations and maintenance instructions and parts manuals for all HVAC equipment.

B. The contractor shall maintain and provide to the School District an accurate set of design plans showing all construction revisions to the design set.

Physical Education and Indoor Practice Facility Guidelines

A. Gymnasiums may be heated and ventilated rather than being provided with mechanical cooling when the HVAC systems are effectively separated from other areas of the building.
B. Indoor Practice Facilities shall be heated and ventilated.
C. Ventilation systems must provide ten air changes per hour in spectator facilities.
D. Ventilation systems must provide five changes per hour in non-spectator spaces.
E. The ventilation must provide intake air near playing floor level and exhaust air at the opposite high wall of the space.
F. Ancillary spaces such as offices and locker rooms shall be served by separate HVAC systems.