West Virginia Department of Education
Division of Student Support Services

Office of School Facilities

"Working Daily with Science, Technology, Engineering and Math (STEM)"

NEWSLETTER

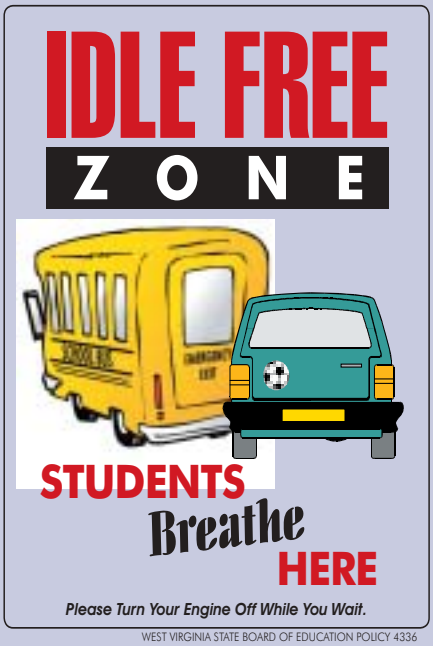
Volume 1, Issue 3

INSIDE THIS ISSUE:

Create an Idle Free Zone, Save Money and the Environment

Identifying ways to save on energy usage is a hot topic with rising fuel prices and the prevailing message to cut costs. One method of curtailing fuel costs while creating a healthy school environment is to include an idle free zone as a component of your facilities plan.

In an effort to address bus idling, West Virginia State Board of Education Policy 4336 was written to minimize idling and offer a smart, effective and immediate way to reduce diesel emissions at little or no cost. Reducing idling saves money because idling wastes fuel. Contrary to popular belief, idling actually does more damage to an engine than starting and stopping. Idling causes additional wear on an engine's internal parts and, therefore, can increase maintenance costs and shorten the life of the engine. Today's bus engines generally require only three to five minutes of warm-up time, even in cold weather. The problem of diesel fuel gelling in cold weather has been resolved by the creation of winter blends of fuel and fuel additives that better withstand colder temperatures.



Studies indicate that students and staff can be exposed to high levels of diesel exhaust when they are inside school buses, near idling school buses, and even inside schools due to the infiltration of exhaust through windows and air intakes. Children are more susceptible to air pollution than healthy adults because their respiratory systems are still developing and they have a faster breathing rate. Diesel exhaust can aggravate respiratory and cardiovascular disease and existing asthma.

To assist in the effort to reduce vehicle idling, the West Virginia

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Office of School Facilities Staff Contact Information:

Dr. Pamela Cain
Assistant Superintendent
Division of Student Support Services
pcain@access.k12.wv.us

Bill Elswick
Executive Director
Office of School Facilities
cwelswick@access.k12.wv.us

Ken Hughart
Certified Indoor Environmentalist
klhughar@access.k12.wv.us

David Bailey
Certified Indoor Environmental Consultant
ddbailey@access.k12.wv.us

Samantha Stamper
Student Safety/Risk Management Coordinator
sstamper@access.k12.wv.us

Understanding the Evacuation Process

Ask three HVAC service technicians what constitutes a good vacuum on an air conditioning system and you will likely get three different answers. The evacuation process is commonly performed but often misunderstood. Executing the process incorrectly can end up leading to costly repairs. The reason for evacuating the refrigeration system is simple. You must remove noncondensables (air) from the system.

Noncondensables in an operating refrigeration system can create some major operational issues. The system will operate at higher than normal condensing pressures as the result of air being trapped at the top of the condenser. This air effectively reduces the condensers capacity to reject heat. This will lead to excessive pressures and temperatures that result in a loss of efficiency and premature component failure. Noncondensables in the form of water vapor also can migrate to the systems expansion device where it can freeze resulting in a total loss of cooling capacity. Water vapor, refrigerant and heat also can lead to the formation of acids inside the system. These acids cause fouling of the oil, increase metal wear, damage valves and cause premature failure of the electrical windings inside the compressor.

How does a technician determine when the evacuation process is complete? Unfortunately, a standard set of manifold gauges are not adequate. To properly measure the evacuation process, the technician needs to use a vacuum gauge that can read in microns. These vacuum gauges are invaluable tools. Manifold gauges measure evacuation levels using a scale based on inches of mercury. There are 25,000 microns between 29 inches of mercury and 30 inches of mercury. Most manufacturers recommend the system pressure be reduced to a vacuum level of between 300 to 500 microns. Reducing the system pressure to this level is only step one of this process. To complete the evacuation process, the evacuation pump must be isolated from the system. The evacuation gauge must be left connected so it can measure the system pressure after the vacuum pump has

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Ladder Safety

Every year thousands of people are involved in preventable ladder accidents. Often times these accidents result in death or serious injury. Many of the injuries sustained in ladder accidents are serious enough to result in lost time from the job. Here are a few tips to help keep you safe:

Ladder Safety Tips

- Make sure the ladder is on firm, level ground.
- When using an extension (non self-supporting) ladder to access a building roof, the ladder should extend at least three feet above the edge of the roof.
- The proper angle for a ladder is achieved when the distance of the ladder from the building at the base is about one-quarter of the working height.
- Do not carry loads on ladders. Hoist loads using a rope/cable system from the building roof or walking surface.
- Step ladders should only be used in the fully open position.
- Touching metal or wooden ladders to an electrical energy source can result in electrocution. Maintain a minimum of 10 feet of clearance from power lines.
- Do not exceed the manufacturer's recommended weight limit.
- Do not lean while working on a ladder. Reposition the ladder closer to the work.
- Wooden ladders cannot be painted with a coating that can hide defects.
- Maintain three-point contact on the ladder (one hand, two feet, etc.).
- Never work above the top three steps of a straight ladder or from the top step of a folding ladder.
- Do not use the cross bracing on the rear section of stepladders for climbing unless they are specifically designed for this purpose.
- Select the right ladder for the job and follow the ladder manufacturer's recommendations.

The Occupational Safety and Health Administration provides a free online guide to OSHA rules regarding stairways and ladders. Inside you will find more detailed information regarding ladder use and compliance requirements.

www.osha.gov/Publications/osha3124.pdf

Operation, Maintenance and Energy Dollars

In fiscal year 2005-2006 West Virginia spent more than $254 million on operation and maintenance expenses related to the operation of educational facilities across the state. This represents approximately 10.5 percent of the total educational budget. Operations and maintenance expenses were second only to personnel costs. The operations and maintenance budget saw a large portion of its money spent on energy expenses. In 2005, energy expenses were approximately $49.5 million . In 2006, the rising cost of energy pushed that number above $53.2 million . In 2006, energy expenses consumed approximately 21 percent of the operations and maintenance budget.

We have huge opportunities to eliminate waste and improve how we operate and maintain our facilities. With no alternative energy source clearly on the horizon, we can only expect energy expenses associated with coal and oil to continue to increase. Obviously, energy management and conservation is a big opportunity at any facility. Improving or changing existing procedures and policies can sometimes improve efficiency and create savings with zero investment. For example, maybe service personnel can travel together in one vehicle. This can lower fuel expenses and perhaps eliminate the expense of an unnecessary vehicle.

Free Cooling: Enthalpy Controlled Economizers

There are many facilities throughout the state that utilize direct expansion (DX) rooftop air conditioning units. Many of these units are equipped with economizers to provide "free cooling" when indoor and outdoor air conditions permit. Many economizers are not functioning correctly or are out of service because their operation is not completely understood. Here is a brief discussion on basic operation of an economizer system.

Due to internal heat loads, such as people, lights, computers, etc., there are times when the temperature outside a building is lower than the temperature inside the building. In these cases, the rooftop air conditioning system can introduce cool outside air to effectively cool the interior space. The economizer is basically a set of motorized dampers that can be opened under certain conditions to allow 100 percent outside air to enter the conditioned space. The economizer is able to provide cooling without running the compressor, condenser fan motor and other related electrical circuits, thus resulting in a significant energy savings.

Most economizers implement a control strategy that measures the enthalpy of the outside air conditions. Enthalpy is the total heat content of the air. It is a way to express the heat and moisture content as one term. This is very important as human comfort is based on both acceptable temperature and humidity levels. If the control strategy was based on temperature alone, the outside air temperature may be low enough to adequately cool the space but may be too humid to provide adequate comfort (like a cool, rainy day). The occupants would feel cool but clammy. Enthalpy control measures the temperature (sensible heat) and humidity (latent heat) levels to determine if the outside air conditions are appropriate for cooling. This provides the greatest comfort at the least cost.

Reference the manufacturer's maintenance manual for specific technical information regarding the economizer operation for your specific unit. The first step to operating and troubleshooting any system is understanding the normal sequence of operation. Make sure economizer operation is verified as part of the routine maintenance plan. This should include, but not be limited to, verifying the drive motor and mechanism are functioning correctly, the dampers are opening and sealing properly, and the sensor is functioning and calibrated. Also, make sure that the economizer opening is protected with some type of screen to prevent animals, birds and debris from entering the unit. Keeping the economizer system in peak operating condition can help reduce the energy costs associated with running a DX cooling system.

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Department of Environmental Protection (DEP) is promoting an "Idle Free Zone" for school buses and other vehicle traffic by providing signs at ***no cost*** to be posted around school campuses, particularly in bus drop areas.

For more information on the **free** signs, contact Tammy Mowrer at the DEP's Division of Air Quality, (304) 926-0499, Ext. 1237, or e-mail at tmowrer@wvdep.org. Additional information on diesel emissions may be obtained by going to www.wvdep.org/daq/, choose the *Diesel Exhaust Emissions* link.

Understanding the Evacuation Process

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been isolated. After the vacuum pump has been isolated from the system, wait 10 to 15 minutes to verify the micron gauge does not reach a level that exceeds 1,000 microns. If the gauge reading does not exceed 1,000 microns during the waiting period the system has been adequately evacuated and is ready to be charged with refrigerant. If the micron gauge reads between 1,000 and 5,000 microns, this is an indication that not all of the moisture has been removed from the system and it requires further evacuation. If the micron gauge reading exceeds 5,000 microns during the waiting period, this is usually a good indication there is a leak in the system. At this point, you need to disconnect the evacuation equipment to identify and repair the system leak.

Evacuation can be a slow tedious process. Rushing the process will only lead to improper evacuation levels that will cause equipment to operate below peak efficiency and experience premature component failure.

Quotes and Facts

- Education ... has produced a vast population able to read but unable to distinguish what is worth reading.—G.M. TREVELYAN
- Reality is the cross referencing of the senses—Unknown
- The trouble with unemployment is that the minute you wake up in the morning, you're on the job.—SLAPPY WHITE
- An average wind speed of 14 miles per hour is needed to convert wind energy into electricity.

Brain Teaser No. 69

How quickly can you find out what is unusual about this paragraph? It looks so ordinary that you would think that nothing was wrong with it at all and, in fact, nothing is. But it is unusual. Why? If you study it and think about it you may find out, but I am not going to assist you in any way. You must do it without coaching. No doubt, if you work at it for long, it will dawn on you. Who knows? Go to work and try your skill. Par is about half an hour.

Answer

The paragraph does not contain any instances of the letter 'e', the most common letter in the English alphabet.

In The Field

- Understanding capacitor sizing may help you out in a pinch. When you wire tow capacitors in parallel, the microfarad (uf) rating becomes the total of the two capacitors. If the capacitors have different voltage ratings (VAC), the voltage rating becomes equal to the lower of the two values.
  - Example: A 20uf capacitor rated at 370 VAC + 15uf capacitor rated at 440 VAC = 35uf capacitor with a 370 VAC rating.
- Step down transformers utilized in heating and air conditioning equipment are rated by voltage and amperage. A typical transformer may have a primary voltage rating and a secondary voltage rating. The other electrical rating found on the transformer is the volt amp (VA) rating. The VA rating is a measure of how many watts of power a transformer can safely handle. Most technicians don't carry a watt meter so we must be able to identify the capacity in terms of amperage. We can use the following formula to find the necessary information: (VA= Watts) (Watts= Voltage X Amperage)
  - Example: We are working with a transformer with the following ratings: 24 volts and 30VA. With this information we can calculate that this transformer can handle 1.25 amps (30VA/24volts=1.25 amps)
  - Many amp meters will not read the low amperages associated with low voltage circuits. To measure the current with a standard amp meter, simply wrap the low voltage wire around the meter clamp ten times. The magnetic field generated will be amplified by the number of wraps around the meter clamp. Divide the inflated reading by 10 to find the actual amperage. If there is not enough slack in the control wiring, an independent wire can be wrapped around the control wire, leaving enough slack to allow the amp meter to be clamped through the loops. This will produce the same results.

With this information, we can determine if the size of the transformer is adequate and we can also determine the correct size fuse necessary to protect the transformer. In both cases typical design practices recommend running the components at 80 percent of capacity.

The West Virginia Department of Education's Office of School Facilities can provide a variety of services to augment and complement what is available at the county level. We have a mechanical engineer and two HVAC technicians on our staff who can assist with a variety of issues that you may encounter in the operation of a K-12 school facility. Our HVAC technicians are certified indoor environmentalists. They can provide both investigation and consultation services on any indoor air quality issue that you may encounter. Whether you need assistance interpreting a policy, resolving a complex mechanical issue or addressing an indoor air quality issue, please feel free to contact the Office of School Facilities for assistance.

Executive Director's Corner

Welcome to our third quarter newsletter. I hope you are finding it useful. It has been a busy summer and the trend is carrying over into the fall. Winter will be here before you know it. Good facility planning and plant operation preparations that are made now will help keep the chill out of your facilities when the cold weather does creep in from the north. Energy awareness continues to be a big initiative for our office. There is a huge opportunity in West Virginia to reduce energy consumption and the associated expenses. Every facility in West Virginia has room to improve its current operations. You will continue to hear the energy awareness as we wrap up 2007 and head into 2008.

Our office is available to provide support on just about any issue you may encounter in your facility operation. Please do not hesitate to contact us for assistance.

Thank You

Bill Elswick
Executive Director
West Virginia Department of Education
Office of School Facilities

1900 Kanawha Blvd. E
Bluilding 6, Room 215
Charleston, WV 25305
304-558-2969
304-558-8867