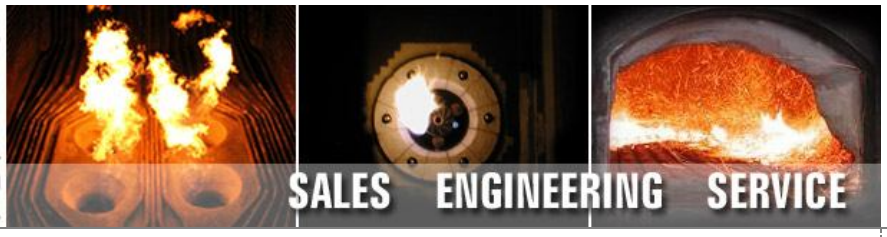
APRIL 2010
VOLUME 2, ISSUE 2

THE CDI QUARTERLY

"Technical News You Can Use"



INSIDE THIS ISSUE

Variable Frequency Drives in the Boiler Room

By Jim Benzing, President

During the late 80's Variable Frequency Drives (VFDs) slowly began appearing in industrial and large commercial fan and pump applications. Unfortunately these drives were plagued with problems and resulted in only marginal success. As a whole, these units were very large and cumbersome, with only limited motor HP capacity. Partly because of their size and the fact they were still an emerging technology; the first drives were also very expensive and required considerable floor space. As a result, VFDs developed a reputation of questionable reliability and applicability. Some early design flaws were the direct result of components that were undersized for the particular application; from control voltage transformers to diodes. Moreover, the drives were not considered user friendly and were exceptionally difficult to program and tune. Additionally, many of the original designs lacked a display screen which made an already complex unit even more difficult to program, and some designs included stacked internal circuit boards that were difficult to access for servicing and field wiring.

By 1992-93 considerable design improvements had been made and many recognized electrical suppliers had begun standardizing certain features and components. Most of the newer models at the time now had a standardized configuration and included industrial quality components and a digital display, all of which made the units more dependable and far more user-friendly.

Today, VFDs cost less and last longer, making them a very attractive investment across most industries. A properly applied VFD coupled to a high efficiency 3-phase AC motor provides reliable performance, significant energy reductions and a very impressive return-on-investment. Adding to the cost savings due to reduced energy consumption are the numerous financial incentives currently available to help offset the cost of investing in the unit. Click here to learn more about available incentive programs or contact us for a free estimate of potential savings.

It is also important to note that the benefits associated with VFDs extend well beyond energy savings. VFDs provide soft starts and stops for 3-phase motors which minimize peak power charges. They also offer infinite motor speed correction for advanced control applications while being capable of highly precise and repeatable control for better process results. Additionally, reduced motor speeds and soft starts minimize sound levels and vibration from powerhouse equipment and reduce wear on motors, bearings, couplings and seals extending equipment life.

Specific Boiler Room VFD Applications

Knowing when and where to utilize a VFD is crucial to achieving a positive return-on-investment. Thankfully, many ideal applications for a VFD exist in the boiler room. Examples include, but are not limited to:

- Almost every fan associated with the boiler (e.g., forced draft fans, induced draft fans and flue gas recirculation fans)
- Most positive displacement pumps (e.g., oil pumps)
- Most significantly over-sized (pressure only) pumps (e.g., a feed pump originally sized for 150 psig that now need only supply 100 psig)
- Most blower applications (Lobe-type blower applications such as purge air, cooling, material handling and transport air fans)
- Make-up air handlers

When not to use a VFD

Equally important as knowing when and where to use a VFD is knowing when and where not to use a VFD. A cursory review of the VFD display screen will quickly determine whether or not the drive has been correctly applied. Any VFD that consistently runs at 57–59 Hz is not reducing energy consumption (in fact the actual

Click the picture above to watch a demonstration of how a VFD can save energy over mechanical devices that regulate flows in pump and blower applications.

Video courtesy of Control Engineering.

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For more information on state, local, utility and federal incentives that promote renewable energy and energy efficiency, such as VFDs, go to the Office of Energy Efficiency & Renewable Energy's website.

electrical power consumption can increase due to energy and thermal losses in the VFD).

Typically VFDs are not recommended for use in any pump application that requires full motor speed to develop the required system pressure. Let's go back to our boiler feed pump example: a centrifugal boiler feed pump that is correctly matched to the boiler's rated capacity and operating steam pressure is typically a poor application for a VFD. In this instance, decreasing the pump speed will reduce pump discharge head (pressure), but it will have little or no change on the supplied volume. This is a problem because volume needs to be reduced during lighter loads, not pressure. The exception to this rule is when a centrifugal pump was originally selected for a much higher operating pressure than is currently required, as mentioned above.

VFDs also should not be applied to HTHW generator or hot oil heater circulating pumps. These heater exchangers are designed for a constant flow and consistent pressure drop, which ensures effective heat transfer regardless of the burner's firing rate.

Recommendations When Installing a VFD

Lastly, here are some points to remember before purchasing or installing a VFD:

- Determine the NEMA rating required for the VFD enclosure and any accessories that may need to be included for the specific project such as; by-pass, line reactors, 3-phase disconnect, forced cooling and internal PID control.
- Select a location that is dry, relatively cool and close to the motor to be controlled.
- All 3-phase wiring should be run in metallic conduit with effective grounding to isolate electrical noise.
- Always separate the control wiring (110 volt and 4-20 mA dc) from the 3-phase power wiring.
- When a replacement motor is required, we recommend a premium efficiency motor designed for inverter duty.
- When applying a VFD to a couple-connected fan or pump, the coupling must be specified for VFD service such that it is capable of accepting reverse thrust during acceleration and deceleration. 🛠

Spring Is Here…Now What?

By Jeff Cobb

Another heating season is almost over (we hope!). Now is the perfect time to plan and begin preparing for next season by taking advantage of lighter steam loads and reduced heating demands. Many items need to be accomplished between now and next fall to ensure your boiler system maintains the reliability, efficiency and safety that is required.

Inspections

Boiler Inspections: Annual inspections of boiler internals are mandatory and typically it is preferable to schedule these inspections during periods of reduced steam loads to minimize any interruption in service.

Deaerator Inspection: As with most other powerhouse equipment, especially pressure vessels, deaerators must be taken out of service regularly to inspect the condition of the storage tank and the spray/tray chamber. Any damaged equipment or equipment showing excessive wear should be replaced to insure the unit is operating as designed. Failing deaerators can damage system components and result in higher boiler chemical costs as additional chemicals are required to combat the damaging effects of excess oxygen and carbon dioxide in the feedwater.

Testing, Tuning and Calibrations

Safety Limit Testing: A minimum of once a year, all of the safety limits should be tested to verify reliable and safe operation. This service should be completed and documented by an expert in the field. Any device that is found to be defective should be replaced prior to placing the unit back in service.

Calibrations: Take advantage of lower steam loads and have all of the plant calibrations completed. Items that need regular calibration include transmitters, switches and flow measurement devices. Accurate fuel flow and steam flow data can provide real time information about operating conditions and potential problems. If you do not currently have this equipment in use consider adding or repairing existing equipment while low steam demand makes it possible.

Manual Gas Valve Maintenance: Do you occasionally smell natural gas around the boiler? There's a good chance it could be the manual gas valves leaking. Very often these valves are overlooked during routine maintenance and over time they will begin to leak as the lubricating grease dries up. To alleviate this problem new grease sticks should be installed. Simply insert a new grease stick and work the valve open and closed a few times to distribute the grease. Contact us with any questions.

Safety Relief Valve Maintenance: Consider developing an annual schedule for testing and replacing safety relief valves. Many plants elect to keep a calibrated spare valve on hand so that a current valve can be removed from service for testing and calibration without the need for the boiler to remain offline for a

UPCOMING INDUSTRY EVENTS

ISA Niagara Frontier Section
Buffalo, NY
April 13, 2010
http://www.isa-niagara.org/

56th International Instrumentation Symposium
Rochester, NY
May 10, 2010
http://www.isa.org/

Electric Power
Baltimore, MD
May 18-20, 2010
http://www.electricpowerexpo.com/

CENTRAL NEW YORK ISA CLAMBAKE
Hinerwadel's Grove
North Syracuse, NY
June 9, 2010
http://www.cny-isa.org/images/CNY-ISA-Clambake-2010.png

2010 ABMA Summer Meeting
Santa Ana, NM
June 25-28, 2010
http://www.abma.com/

Coal Gen
Pittsburgh, PA
August 10-12, 2010

prolonged period.

Boiler Combustion Tuning: New York RACT Law requires that combustion sources between 20 MMBtu and 50 MMBtu be tuned each year by a qualified expert. Although a sufficient heating load (or the ability to vent excess steam) is required to properly conduct this calibration, scheduling this service early guarantees your units are firing properly before the heating season arrives, and permits the peace of mind that you're in compliance with state regulations.

Efficiency Improvements and Upgrades

Boiler & Deaerator Controls: Are your controls obsolete, inefficient or failing on a regular basis? Now is the time to consider system upgrades so they can be installed and tested before the heating season returns. A Return-On-Investment of less than one year is not at all uncommon when replacing obsolete systems!

Variable Frequency Drive (VFD) / Variable Speed Drive (VSD): If your plant is not taking advantage of available energy savings that result from varying motor speeds during periods of lighter load, now may be the time to consider installing VFDs. Not only do these drives result in significantly reduced energy costs, they reduce wear on equipment. Ask us how! Better yet, government rebate programs exist that help offset the cost of the drive. Hands down, VFDs are a great application in just about any boiler room.

Safety System Upgrades: Many older Burner Management Safety Systems and limit devices no longer meet NFPA or FM Global standards, and may not be supported by the manufacturer. Now may be the time to have your system evaluated to ensure it conforms to the latest safety regulations. 🛠

What You Need To Know About Flame Scanners

By Jeb Benzing

Regardless of the combustion equipment currently in use at your installation, it's more than likely you have at least one flame scanner. The reason for this is fairly straightforward; they're required by Standard 85[1] from the National Fire Protection Association (NFPA), as well as other industrial standards. Not only are flame scanners a requirement, they form an integral part of your boiler's overall safety system. Simply stated, flame scanners are used to detect the presence of a flame throughout all phases of operation.

Flame scanners can be broken into two general categories: physical or optical scanners. In the simplest of terms, physical scanners such as flame rods rely on a current loop that is formed when the rod contacts a flame (as the rod comes into contact with a flame, a flow of ions from the flame rod passes through the flame and on to a ground). When the flame rod loses contact with the flame, it loses the ability to conduct a signal via the established current loop. The burner management system (BMS) immediately recognizes this and responds to the unsafe condition accordingly, by forcing the fuel valve closed. Although physical scanners are relatively reliable and fairly inexpensive, they are seldom utilized on large combustion applications.

The most common type of flame scanner found in our industry is the optical scanner. Optical scanners rely on the radiation emitted by a flame for detection and can be further broken down into two categories: ultraviolet (UV) scanners or infrared (IR) scanners. IR scanners are generally less complex than their UV counterparts and therefore typically less expensive as well. Most UV scanners consist of a housing containing a gas-filled tube and two electrodes. When the gas-filled tube is subjected to the (UV) radiation of a flame, the gas ionizes and permits current to flow from one electrode to the other. This current flow provides an indication to the BMS that a flame is present allowing combustion to continue.

UV scanners are available as either self-checking or non self-checking scanners. UV scanners with a self-checking feature generally include an electromechanical shutter that cycles at a regular interval to prevent exposure of the tube to the flame. The scanner amplifier processes this regular absence of flame to verify proper function of the scanner and to prevent an accidental fail-on condition. Self-checking scanners are required on burners that fire without cycling at least once in a 24-hour period (see NFPA 85). Although this is the minimum standard required, it is highly advisable that all scanners be of the self-checking type to prevent a scanner from failing "on".

Alternatively, IR scanners use a photocell to detect the IR radiation (heat signature) produced by a flame. In a similar manner, the scanner amplifier interprets the signal produced by the IR scanner and indicates the presence of a flame to the BMS to allow for safe operation. Although IR scanners do not fail "on" like their UV counterparts, they can misinterpret the heat signature produced by hot refractory as that of a flame and provide indication to the BMS that a flame is present when in fact that is not the case. As such, IR scanners

http://www.coal-gen.com/index.html

Power–Gen
Orlando, FL
December 14-16, 2010
http://www.power-gen.com/index.html

DID YOU KNOW?

Did you know that a ground shield wire from a transmitter that has been landed in two locations (both ends) can create an antenna in the boiler room that interferes with output signals? The same is also true if neither end has been landed!

To avoid this, always land one end of the ground shield wire and tape off the other end with high quality electrical tape.

should never be used when there is the potential for furnace refractory to be in the line-of-sight of the scanner.

According to a leading manufacturer of flame safety equipment; *UV scanners are recommended for detecting flames from standard fuel gases, some waste gases and light oil fuels such as No. 2 oil. Flames from heavier oils can be detected with UV scanners but the unburned fuel shroud and/or atomization shroud can block passage of the UV from the flame zone to the UV tube, causing nuisance burner/boiler trips. Infrared detection is recommended for fuel oil heavier than No. 2, and some installations where waste gases are burned together with natural gas as a main flame*[2].

Significant improvements in scanner technology have resulted in scanners that are sturdier, safer and more reliable. Additionally, manufacturers now offer scanners that combine the amplifier and scanner body, minimizing space requirements in the BMS panel and generally eliminating the hazard of 120V AC being run to the burner front as the condensed unit now operates off 24V DC.

The truth of the matter is that many different makes and models of flame scanners exist; however, for any number of reasons the optimal scanner is not always supplied at the time of installation. If your boiler has substantial refractory and you're using an IR scanner you may want to consider upgrading to a UV scanner. Similarly, if you're still using a non self-checking UV scanner or a scanner that is considered obsolete by the OEM, you could be one scanner failure away from an extremely unsafe condition. Relative to many other pieces of equipment in the boiler room, a flame scanner is an inexpensive item that is critical to the safe operation of your boiler. Remember – safety first! 🛠

REFERENCES

[1] National Fire Protection Association, NFPA 85: *Boiler and Combustion System Hazards Code, 2007 Edition*, Quincy, MA, 2007.

[2] Fireye, Inc. *Fireye Flame Scanners: Bulletin SC-102*, Derry NH, July 17, 2009.

How Does EPA's New "Mandatory Reporting of Greenhouse Gas Rule" Affect You?

By Jeff Cobb

I'm sure everyone has heard of this rule, but do you really know what it means and how it affects your installation?

In response to growing environmental concerns and the Consolidated Appropriations Act of FY2008 (H.R. 2764; Public Law 110–161), the Environmental Protection Agency (EPA) passed the "Mandatory Reporting of Greenhouse Gases Rule" in October of 2009 (review EPA's website dedicated to the rule). This new rule mandates the monitoring of, and annual reporting on, greenhouse gas emissions effective January 1, 2010. Although this date has already passed it seems many are still confused about what is required to conform to this new environmental reporting requirement.

Without question, this rule directly impacts many in our industry. In its simplest form, the rule requires any facility with stationary combustion equipment that produces in excess of 25,000 metric tons of carbon dioxide equivalents ($mtCO_2e$) or more of GHG emissions per year to report data on emissions. For initial reporting purposes, the EPA has supplied the following generalities to help determine if this rule applies to your facility. If you exceed any of the following maximum rated heat input capacities you must report:

> **Coal firing**: the sum of the maximum rated heat input capacity for all stationary fuel combustion units at your facility less than 30 million British thermal units (Btu) per hour.
>
> **Natural gas firing**: the sum of the maximum rated heat input capacity for all stationary fuel combustion units at your facility less than 50 million British thermal units (Btu) per hour.
>
> **Fuel oil firing**: the sum of the maximum rated heat input capacity for all stationary fuel combustion units at your facility less than 35 million British thermal units (Btu) per hour.

For those who have to report, the first report is due March 31, 2011. The good news: if annual reporting demonstrates that your facility generates less than 15,000 metric tons of CO_2 per year for three consecutive years or 25,000 metric tons of CO_2 per year for five consecutive years you may receive an exemption from future reporting. Similarly, if any CO_2 generating units are taken offline reporting requirements may no longer apply; however, the EPA must be notified of any of these circumstances. Please note that any changes resulting in increased greenhouse gas emissions, may reinstate reporting requirements.

The EPA has allowed for a few options for monitoring and reporting depending on the fuels fired and existing equipment that may be in service. It is our professional opinion that this reporting will evolve into more stringent regulations in the future. Click here for Special Reporting Provisions for 2010.

Combustion Designs, Inc. has focused on emissions and advancing technology for many years. If you are interested in additional information about the Mandatory Reporting of Greenhouse Gases Rule, or if you

Click the picture above to review the EPA's presentation of Rule or follow this link.

Still puzzled about whether or not the Mandatory Greenhouse Gas Reporting Rule is applicable to your facility? Run the EPA's Applicability Tool to assess whether or not your facility is required to report greenhouse gas emissions.

Run the Applicability Tool »

require assistance in meeting the monitoring and reporting requirements please contact us.🛠

This newsletter was sent to our valued customers and partners in an effort to provide them the latest industry news and information about our capabilities.

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Combustion Designs, Inc.
132 Albany Street
PO Box 643
Cazenovia, NY 13035

contact@combustiondesignsinc.com

www.combustiondesignsinc.com