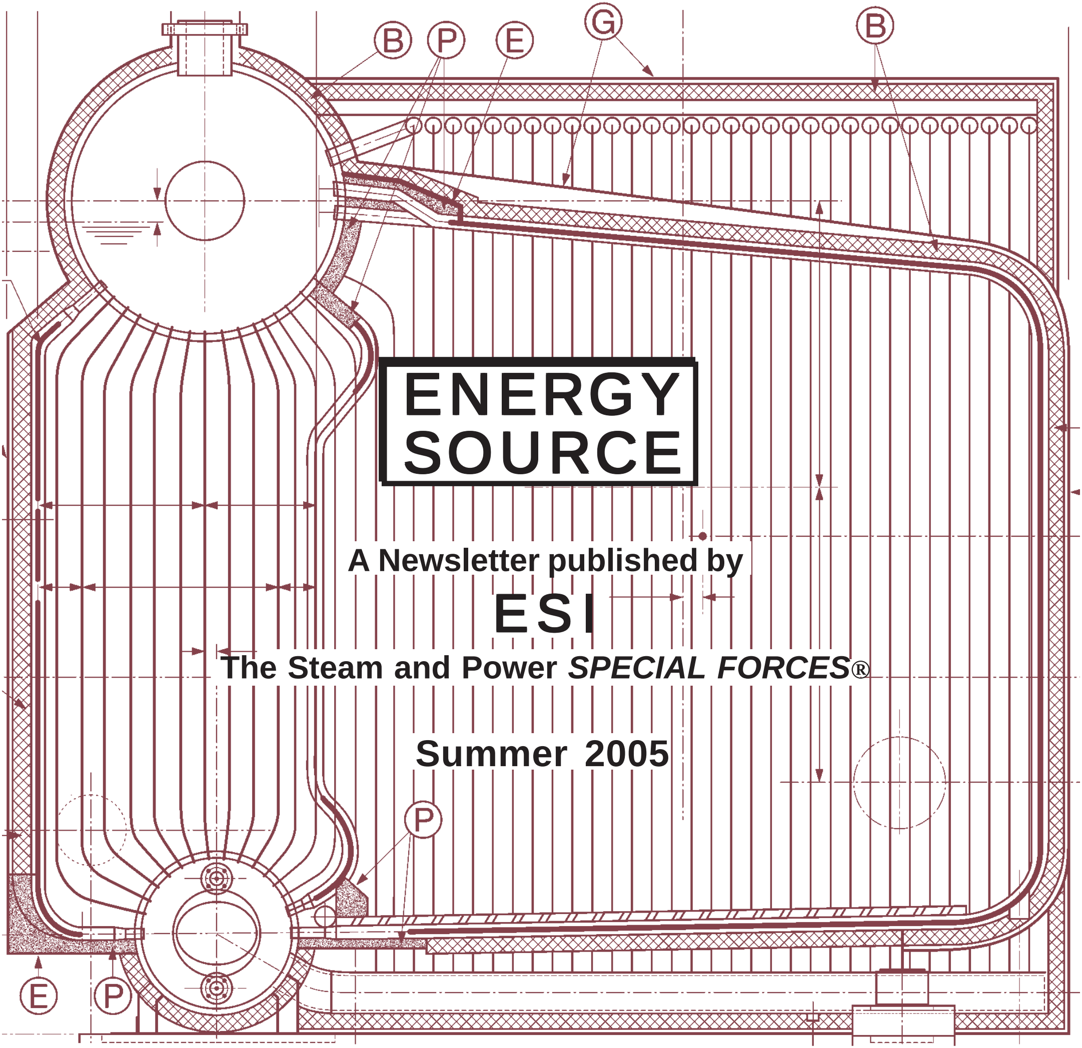


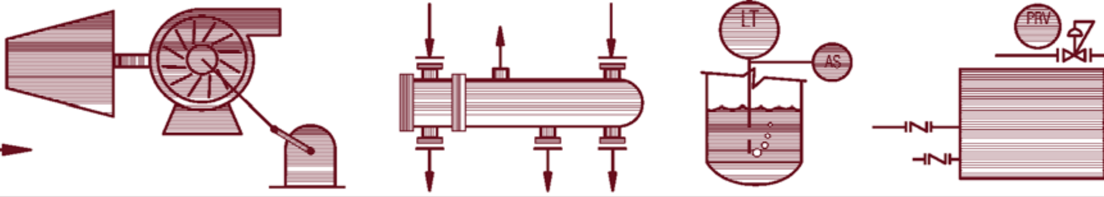
ENERGY SOURCE

A Newsletter published by

ESI

The Steam and Power *SPECIAL FORCES*®

Summer 2005



Does Your Steam System Need a Check-Up?

By: Jackson A. Brown, P.E.,
Manager - Mechanical Engineering, ESI

Before you answer this question, please consider the following: (1) In one plant, the 125 psig header pressure was lowered first to 115 psig and then lowered to 100 psig without affecting plant operations in any way. The plant calculated that this no cost modification reduced their energy consumption by approximately 8%. (2) If your steam costs $4 per thousand pounds to generate, a 1/8” diameter hole (common trap orifice size) will leak approximately $2,000/year worth of steam at 100 psig and approximately $7,400/year at 400 psig. Don’t answer yet; a few statistics, which were gathered by the DOE and other organizations, should be considered first. (1) It is typical for most plants to have 15-30% of their traps either malfunctioning or improperly selected. (2) A typical steam system leak rate is 3-5% of the system flow. (3) 5-10% of most plants’ steam system insulation is deteriorated to an unacceptable level. (4) Typically, steam trap maintenance and replacement programs have a payback of 3-6 months with typical reported savings of $80,000-$500,000 per year. Now you can answer! If yes, please keep reading for some important information regarding steam system optimization.

Potential steam consumption reduction opportunities can fall into one of the following categories: initial design inconsistencies, steam system or process changes, maintenance issues, and overall plant steam system imbalances.

When a facility is being designed, steam load requirements throughout the system are summed (as accurately as they can be determined at that time), operating pressures are assigned, and based on that information a boiler plant and steam distribution system is designed. Unfortunately, these initial designs are often not revisited as final detailed information is received. If you understand that equipment load and pressure requirements can change once the final design has been completed and that load and pressure margins are often added during the initial design phase, it is easy to see that a steam system might not be optimally designed from the first day of operation. Even if the system is optimized at the initial start-up, process and/or equipment changes over the years can certainly change that. It is therefore imperative that a thorough survey and analysis of a plant’s steam system be conducted on a regular basis. This item should certainly be close to or at the top of any plant’s energy use opportunity list, since significant cost saving results can often be achieved with minimal capital expenditure.

With regards to maintenance, steam traps are seldom maintained as they should be. A simple trap survey using an infrared temperature sensor followed by trap repairs or replacement can result in very significant energy reductions.

Continued on Page 2

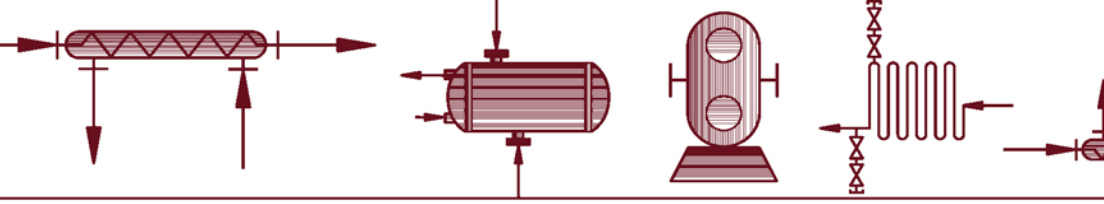
ENERGY SOURCE

The *ENERGY SOURCE* is published quarterly for customers, employees, and friends of ESI Inc. of Tennessee.

ESI is the Steam and Power *SPECIAL FORCES®* providing clients with innovative, cost-effective, and environmentally-friendly solutions.

If you have any suggestions or comments about the newsletter feel free to call us at 770-427-6200 or e-mail us at energysource@esitenn.com.

Deanna White
Managing Editor



Does Your Steam System Need a Check-Up?... *Continued from Page 1*

Taking an overall plant steam system approach will often uncover low cost optimization opportunities. In one plant where two 150 psig headers existed in adjacent buildings, one header was venting excess steam while, in the building next door, high pressure steam was being PRV'd to supply the other 150 psig header. A simple interconnection of the two headers resolved the issue.

A successful steam system optimization program should include:

- A plant-wide steam system survey to identify opportunities at both the utility and process levels
- A list of steam efficiency improvement opportunities
- Accurate system data to assist with prioritizing opportunities
- Initiation of the most desirable changes
- Follow up on system monitoring to validate changes and insure that results are maintained along with reports to convey that information

Depending on the complexity of a steam system, a survey can vary in magnitude from a few simple hand sketches and calculations to one requiring several man-days and some appropriate software. A few items that might be considered in your plant-wide steam system survey include:

- Eliminate or find a use for vented steam
- Use a turbine as a driver to minimize PRV letdown and electrical consumption
- Isolate unused steam lines
- Repair steam leaks immediately
- Maintain all steam traps (and check for proper trap application)
- Shift users to lowest pressure header possible and minimize steam pressure header for users
- Minimize deaerator vent steam
- Check steam turbine applications to maximize turbine efficiency
- Repair damaged insulation and consider economical insulation thickness
- Review condensate recovery (what was once expendable condensate is now a valuable commodity)
- Operate most efficient boiler(s) while satisfying process steam load
- Revisit hot standby boiler procedure (use mud drum heater instead of firing burner)

One thing to remember is that successful energy management is built around accurate data and proper response to energy-related parameters. It is a fact that items which are not accurately and methodically measured usually cannot be properly managed.

A very valuable tool in analyzing existing steam system conditions as well as identifying and analyzing system improvements or changes is a steam system modeling program. Steam system modeling can help pinpoint steam-saving ideas as simple as control logic changes or the connecting of two unbalanced low pressure steam headers resulting in a better steam system balance.

An integrated total plant approach is the only way to handle this operational aspect; however, an effective program can be planned, structured, and initiated, and end up being limited by organizational thinking and reactive style (facility or corporate culture). An applicable performance culture must be envisioned by the project leaders and

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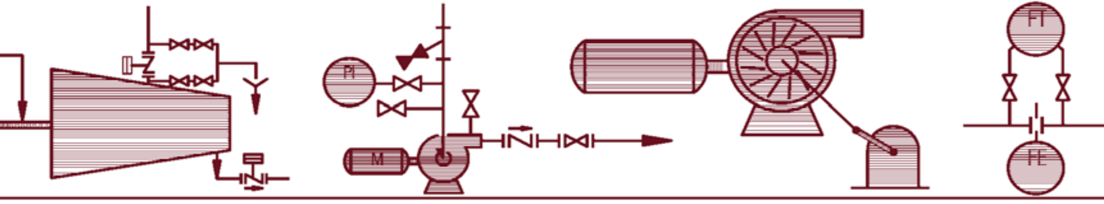


"ELECTRICAL CLASSIFICATIONS OF HAZARDOUS LOCATIONS"

By: Mark D. Lassetter, P.E.
Manager- Electrical and I/C Engineering, ESI

During the electrical design of a project, one of the most critical aspects to determine is the electrical classification. The classification can significantly affect the costs of the electrical equipment and the installation.

The National Electrical Code (NEC) classifies an area as "hazardous" as one "where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or flyings" (Section 500.1). If an area is not classified as hazardous, then it is simply called "unclassified". The NEC defines three different types of hazardous locations: Class I, Class II, and Class III based on the properties of the materials that are present and that a flammable or combustible concentration or quantity is present (Section 500.5).

A Class I location is created by the presence of flammable gases or vapors. A Class II location is created by the presence of combustible dust. A Class III location is an area where there are easily-ignitable fibers or flyings.

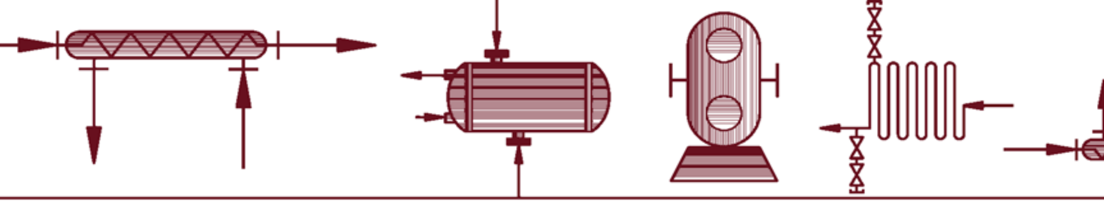
The NEC further classifies hazardous areas by the kinds of conditions under which the hazardous materials exist. A Division 1 classification is applied when the hazardous material can be expected in ignitable concentrations or quantities during normal operations or during repair and maintenance work. A Division 2 classification is given when the hazardous material is present only after some unusual event such as the accidental rupture of a container, failure of a ventilation system, or as in the case of a combustible dust, where there is enough accumulation of the material on a piece of electrical equipment to interfere with the safe dissipation of heat. Section 500.5 of the NEC provides more details and definitions of Division 1 and 2 within the Class I, II, and III classifications.

Lastly, Section 500.6 of the NEC adds a third level, group, to the classification based on the hazardous material itself. Examples of materials found in the various groups are as follows:

A - Acetylene
B – Hydrogen
C – Ethylene
D – Propane, Natural Gas, Gasoline
E – Aluminum Dust (combustible metal dust)
F – Coal Dust (combustible carbonaceous dust)
G – Flour, Starch, Wood Dust, Grain, etc.

Groups A, B, C, and D are always classified with Class I locations, while Groups E, F, and G are Class II locations. Section 500.6 of the NEC provides more details and definitions of what types of materials are found in each group.

Continued on Page 5



Does Your Steam System Need a Check-Up?... *Continued from Page 2*

then be integrated into the facility personnel from top level management down to the production floor. Before an optimization program can be successful, all parties involved should understand that energy (steam) management is a key component of proper and competitive plant operation. To further ensure success, the program should be a plant-wide team effort without any personnel, system, building, or process barriers. The potential penalty for ignoring or overlooking this very important factor can be from limited program success to total program failure.

Environmental PR can also boost the desirability of this program by relating all beneficial changes/modifications not only in terms of cost per production unit, but also in the correlated power plant emissions reduction.

After this program has been initiated, a system of checks and balances should be in place such as:

- Have a written set of instructions and SOP's (Standard Operating Procedures) for all operating areas of the entire steam system
- Perform and record routine steam-related maintenance inspections
- Develop and monitor the steam system performance at the manufacturing level – energy versus production

In conclusion, to excel in today's business climate, a plant which utilizes steam must:

- Emphasize steam optimization during design phases
- Manage steam use optimization as a part of day-to-day business
- Adequately equip all systems with instrumentation, monitoring equipment, and controls to allow accurate monitoring and assignment of energy use

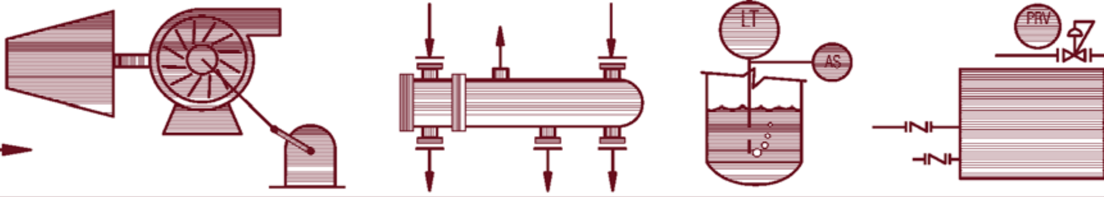
Once this program is successfully underway, the person(s) in charge should begin working towards future goals such as:

- Increased steam use efficiency
- Increased use of monitoring equipment and data
- Have a plant culture where energy awareness/steam utilization is understood and practiced at the engineering and plant operations levels
- Increased use of process control/energy optimization hardware and software

Additional ways to discover and capture savings opportunities are by sharing experiences within and outside the company and increasing interaction between facility's operation and management to reconcile production and engineering data with the financial and corporate priorities.

Each plant has its own site-specific steam system which must be thoroughly analyzed for optimization opportunities. Other important resources for improving operations include steam system consultants and service providers who can perform system assessments, troubleshoot performance problems, and identify additional improvement opportunities. If you need assistance with your steam system's check-up, please contact ESI at 770-427-6200 or info@esitenn.com.

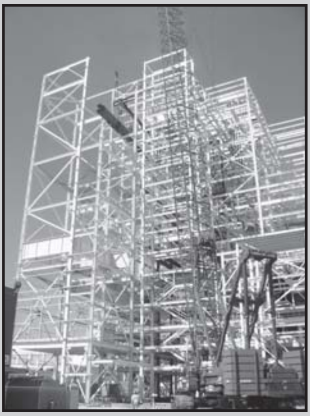
Note:
The U.S. Department of Energy offers tools and resources to assist steam users in improving operations. Visit www.oit.doe.gov/bestpractices/steam for this valuable information.



New 1,100,000 PPH Coal-Fired Steam Facility

Corn Products International
Bedford Park, Illinois

ESI is excited to announce that boiler erection began on Saturday, August 6, 2005 and that steel erection is approximately 50% complete. The photograph on the right shows the setting of the steam drum which is 73 feet long, has an outside diameter of 63.5 inches, and weighs 131,500 lbs. A 250 ton crane was used to set the drum.

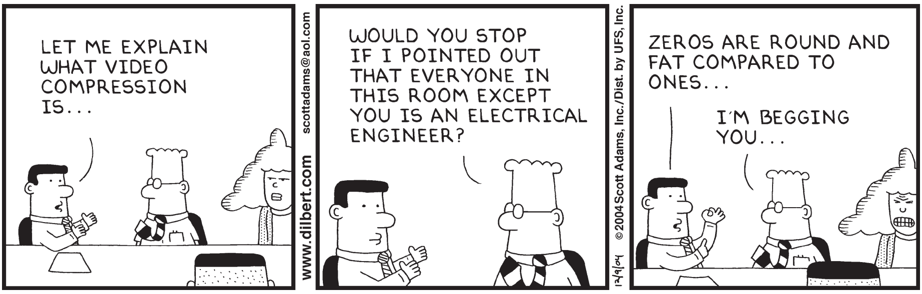


ESI is the engineer and construction manager for this new 1,100,000 pph coal/pet coke/ natural gas-fired facility. This facility will include a field-erected circulating fluid bed boiler designed to provide 650 psig/750°F superheated steam to the plant process. The facility will also include complete coal and pet coke material receiving, storage and handling systems; ash storage and handling systems; limestone receiving, storage and handling systems; boiler feedwater pumps; SNCR system; air emission control system; continuous emission monitoring system; Foxboro distributed control system; and a new 250-foot dual-wall stack. The estimated completion date for this facility is Winter 2006.

ELECTRICAL CLASSIFICATIONS... *Continued from Page 3*

To prevent explosions, the NEC directs the required wiring methods utilized in the respective classifications. These wiring methods attempt to eliminate any source of ignition of the hazardous material. Sources of ignition include arcs, sparks, high temperatures, and electrical equipment failures. Article 501 of the NEC provides details for electrical equipment and installations within Class I locations. Article 502 provides the details within the Class II locations and Article 503 is for Class III locations.

As stated at the beginning of this article, the electrical classification must be determined during the early stages of the electrical design of a project. The referenced sections of the NEC can provide valuable guidance to determining the appropriate classification.



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