Suggested Actions

- Work with process heating specialists to estimate energy savings from using precise furnace pressure control.
- Contact furnace or combustion system suppliers to obtain cost estimates so you can calculate payback or return on investment.

Resources

U.S. Department of Energy— For additional information on process heating system efficiency, to obtain DOE's publications and Process Heating Assessment and Survey Tool (PHAST) software, or learn more about training, visit the BestPractices Web site at www.eere.energy.gov/industry/bestpractices.

Furnace Pressure Controllers

Furnace draft, or negative pressure, is created in fuel-fired furnaces when high temperature gases are discharged at a level higher than the furnace openings. This is commonly known as the *chimney effect.* The negative pressure in a furnace that operates at a fixed temperature changes with the heat input rate or mass flow of flue gases moving through the stack. This negative pressure causes ambient air to leak into the furnace.

Figure 1. Air infiltration from furnace draft

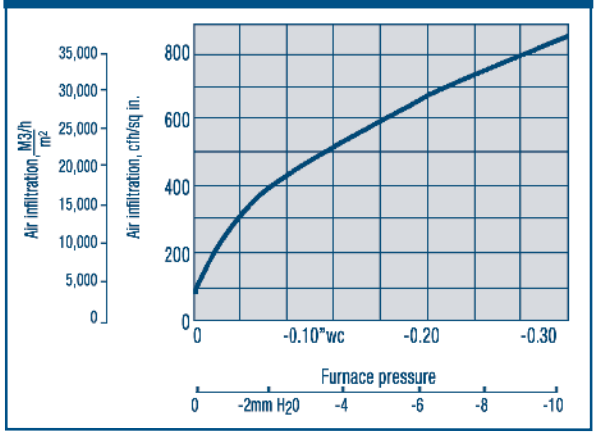
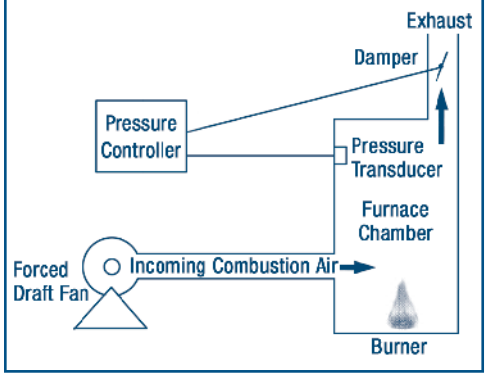


Figure 1 shows rates of air infiltration resulting from furnace draft. This air has to be heated to the flue gas temperature before it leaves the furnace through the stack, which wastes energy and reduces efficiency. The air infiltration can be minimized by reducing or eliminating openings and areas of possible air leaks and by controlling pressure in the furnace. Examples of openings include leakage around burner mountings, seals around heater or radiant tubes, doors that are opened and closed frequently, and observation ports.

Furnace pressure controllers regulate and stabilize the pressure in the working chamber of process heating equipment. Pressure controllers use a pressure gauge in the furnace chamber or duct and regulate the airflow to maintain a slightly positive pressure (a few inches of water gauge) in the furnace chamber (see Figure 2). Airflow can be regulated by varying the speed of draft fans or by changing damper settings for the incoming combustion air or the exiting flue gas.

Figure 2. Furnace pressure controller



Pressure controllers can be manual or automatic. An equipment operator typically uses a dial on a control panel to set the pressure in a manual system. An automatic system has a feedback loop and continuously monitors and regulates the pressure through an electronic control system. A barometric damper is an inexpensive option for a natural draft furnace or oven.

Four types of draft systems are used in industrial furnaces:

- **Natural.** Uses the chimney effect. Gases inside the stack are less dense and will rise, creating a vacuum that draws air into the furnace.

- **Induced.** A fan draws air from the furnace to the stack.
- **Forced.** A fan pushes air into the furnace.
- **Balanced.** Uses an induced and a forced draft fan.

Furnace pressure controllers can work with any of these systems. Properly sized stack diameters and dampers (or fan speed control) must be used to control furnace pressure for the entire range of furnace operation or firing rates. For safety reasons, controlled atmosphere furnaces require positive pressure and special pressure controllers; furnaces and ovens with volatile vapors (from operations like paint drying) require slightly negative pressure.

Benefits

Maintaining slightly positive furnace pressure can have many benefits, including:

- **Energy savings.** Positive pressure eliminates cold air infiltration, which reduces fuel consumption.
- **Improved product quality.** Process heating equipment with regulated pressure control will help maintain a more uniform temperature in the furnaces and avoid cold and hot spots, which can improve product quality. For heat treating applications, positive furnace pressure can reduce oxidation, and for processes like carburizing, create a more stable atmosphere for the diffusion process.
- **Maintenance savings.** Pressure control prevents excessive fluing through cracks and doors in process heating equipment, which can minimize corrosion and crack enlargement.
- **Emissions Reductions.** Improved combustion control can reduce emissions.

Reference

Improving Process Heating System Performance: A Sourcebook for Industry. U.S. Department of Energy (DOE) and the Industrial Heating Equipment Association (IHEA). This document can be obtained from www.oit.doe.gov/bestpractices/library.shtml.

BestPractices is part of the Industrial Technologies Program Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and best energy-management practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

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