Energy Innovators Initiative

Technical Fact Sheet

Use of Automatic Vent Dampers for New and Existing Boilers and Furnaces

Description

Boiler and furnace efficiency is usually defined in terms of steady-state operation. Efficiency measurements are taken and reported after the appliance has been running for a few minutes and has reached operating temperature. However, when appliance standby and skin losses are taken into account, the long-term or seasonal efficiency is usually much lower. In the case of combustion appliances vented to the atmosphere, average standby time ranges from 85 to 90 percent if they are sized properly for their design loads. During this time, warm room air is drawn through the stack via the draft hood or dilution air inlet at a rate proportional to the stack height, diameter and outdoor temperature. More air is drawn through the vent immediately after the appliance shuts off and the flue is still hot.

A vent damper, when closed, can prevent residual heat from being drawn up the warm vent. Vent dampers can also reduce the amount of air that passes through the furnace or boiler heat exchanger, which can slightly increase operating efficiency by reducing the time needed to achieve steady-state operating conditions. Also, by reducing air infiltration, vent dampers can help to retain humidity in the building, which can improve comfort in the winter months.

Figure 1 – Honeywell Electromechanical Vent Damper

Technical Specifications

Two common types of vent dampers available are electromechanical and thermomechanical. The electromechanical vent damper (Figure 1) is coupled with the gas valve. For example, the vent damper will start to open on a call for heat. After a short delay of 15 to 30 seconds to ensure that the damper is open, the gas valve and ignition are activated. Conversely, the damper will close when the heat demand is met and the gas valve is closed. A thermo-mechanical vent damper opens when the temperature increases and closes when the temperature is sufficiently low.

The vent damper is typically installed in the flue pipe between the heating unit and the chimney. It is usually installed downstream from the draft hood (for boilers), but can be integrally installed upstream of the draft hood.

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Energy Information

If the boiler or furnace is located indoors (within the heated envelope), up to 11 percent[1] of the total heating energy may be lost in heating make-up air. If the appliance is part of an isolated combustion system (ICS) – such as in an unheated crawl space – or located in an isolated mechanical room, then it does not heat the combustion air or make-up air. In this case, using a vent damper can reduce costs for energy by as much as 4 percent. A sample calculation of energy and cost savings for a stack damper installed on a boiler located within the heated envelope is shown in Table 1. A stack damper is normally installed with an electronic pilot ignition, which is necessary to bring the seasonal efficiency (AFUE) up to the minimum 79-percent requirement for mid-efficiency heating appliances. However, a stack damper can be added to a furnace or boiler with a standing gas pilot, as long as some leakage is allowed in the damper design. Most manufacturers can accommodate this application.

A typical automatic vent damper uses almost no power when not operating and can be ignored when calculating energy consumption. When in operation, it uses only about three watts of power.

Stack dampers, available in sizes ranging from 12 to 30 cm in diameter, cost approximately $150 to $350. Appliances with a standing pilot should be retrofitted with an electronic ignition when possible. The cost for this varies depending on the system. Electronic ignitions must be installed by a qualified professional, and retrofits are normally completed in less than a day.

Table 1 – Sample Vent Damper Installation Payback

Equipment	
Boiler Plant Size (Btu/hr)	400 000
Full Load Annual Operating Hours	900
Annual Consumption (GJ)	380
AFUE (pre-retrofit)	71.0%
AFUE (post-retrofit)	79.0%
Savings	
Annual Savings (GJ)	39.0
Cost per GJ (at 2000 prices)	$8
Annual Savings	$312
Costs	
Vent Damper	$300
Ignition System (if required)	$400
Installation Cost	$500
Total	$1,200
Payback	
Simple Payback Period (years)	3.85

Comparison

Vent dampers are relatively simple devices, although very few companies manufacture them. Honeywell and Effikal, both well-known suppliers, offer CSA- and AGA-certified products. One advantage of the Honeywell Model A896 vent damper is that it fits tightly. For systems with a standing pilot, a plug is removed to allow some air to pass through.

Case Study

At Sherwood Park Elementary School, in the North Vancouver District School Board in British Columbia, vent dampers have been used in several recent multiple-boiler installations. Figure 2 shows two Burnham Model 810 594 000-Btu/hr boilers fitted with Effikal vent dampers. Both boilers were monitored under similar weather conditions for a two-week period. During the first week the dampers were left operational, and during the second week they were deactivated. The results indicated that the average temperature in the stack when the boiler was idle ranged from 30–35°C, while the boiler room temperature was about 21°C. This means that heat from each boiler was being removed through the stack at a rate of 0.01 GJ/hr. Over the heating season, the heat losses from the room and the boilers would be around 165 GJ, which at 2001 gas prices would cost $1,730 a year.

[1] *ASHRAE Systems Handbook 2000*, Chapter 28, p. 28.7.

Figure 2 – Vent Damper Installation on Boilers

For more information, contact

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