CENTER FOR ENERGY AND ENVIRONMENT

Technical Fact Sheet

Multifamily Facility Management Services

HIGH EFFICIENCY RETROFIT FOR GAS CONVERSION BOILER

Description:

"Gas Conversion" refers to a boiler that was originally designed to burn coal, but has been retrofitted with a natural gas burner. This burner may either be atmospheric or power draft. An atmospheric burner is one in which both the fuel and the air are delivered to the combustion chamber at atmospheric pressure. By contrast, a power burner is one in which the air for combustion (and sometimes the fuel as well) is supplied to the combustion chamber at a pressure higher than atmospheric pressure.

Gas conversion boilers tend to be very good candidates for high-efficiency retrofits since the combustion chamber and flue of a boiler that is designed to burn coal is much larger than required for burning gas. As a result, airflow through the boiler is usually not uniform. (Airflow should ideally be slightly positive in the combustion chamber and slightly negative at the breaching.) In addition, there are often substantial air leaks into the combustion chamber from around doors or the burner itself. Both problems ordinarily lead to very high levels of excess air, and high levels of excess air results in low boiler efficiency. Why? Excess air will tend to absorb the heat that combustion produces and carry it out the stack before it can be transferred to the heat exchanger. The smaller the volume of excess air, the less heat will be lost out the chimney.

Conversion boilers equipped with atmospheric burners are typically the very best candidates, since power burners have more accurate air settings that tend to restrict excess air more precisely and that don't get out of adjustment as easily.

How to Implement:

All modifications must be made by a qualified, licensed and bonded contractor and must be done within local code restrictions. In addition all adjustments should be deemed feasible and safe by the contractor performing them.

Before a high efficiency retrofit is begun, a basic inspection and maintenance service should be completed by the contractor. This service should include inspection and repair as necessary of the burner, combustion chamber, combustion blower (if applicable), pilot light (if applicable), heat exchanger, all flues and vents, and all safety controls.

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In general the goal of the high efficiency retrofit is to reduce excess air to a minimum while maintaining safety margins. To accomplish this in a boiler that has a conversion burner, retrofit strategies vary, but should include those listed below.

High Efficiency Retrofit Strategies For Conversion Burners

1. Adjust manual/motorized draft louvers to reduce the secondary air to minimum.
2. Seal unnecessary gaps and/or holes into the combustion chamber.
3. Install flue restrictors to further reduce the secondary air if required by placing fire bricks at the throat of the flue opening, installing a permanent sheet metal restrictor in vent pipe before diverter, or reducing the size of the vent pipe between the boiler and diverter.
4. Install baffles on the bridge wall to turbulate flow of combustion products.
5. Uprate the gas burner to reduce secondary air by increasing gas pressure at the gas valve, or increasing orifice size on burners.
6. Derate the gas burner to reduce stack temperature by decreasing gas pressure at gas valve, or decreasing orifice size on burners.

The contractor performing the high efficiency tune-up should use an electronic flue gas analyzer and provide the pre- and post- retrofit results. Final steady state efficiencies for most conversion boilers after this retrofit should be at least 78% and often efficiencies as high as 82% are achievable.