BASIC OPERATION AND COMPONENTS OF AN EFFECTA LAMBDA BOILER SYSTEM WITH ACCUMULATOR TANKS (WATER BATTERIES) AND LADDOMAT LOADING VALVE

In Sweden it is against the law to operate a cycling type boiler. A boiler which cycles cannot even come close to meeting the emission requirements/standards in Sweden (after all, this is a country which requires its people to separate the food scraps from the other garbage so that the food scraps can be put into a large tank, fermented and Methane gas extracted and used to power cars and busses-*the garbage companies will do the sorting and will invoice people who do not sort their garbage in this manner!)* Thus, products used in Sweden must be engineered to be extremely efficient, easy to use and long lasting. On the other hand, in the USA, we do not have the same strict requirements and as such are not forced to engineer & manufacture products of this quality and efficiency.

A cycling boiler does a relatively poor job of heat (BTU) generation. The emissions produced by smoldering wood are very harmful to our environment (and next generation) and is not the most efficient method of providing heat to a home.

The basic components of an Effecta Lambda Boiler System are:

Effecta Lambda Controlled Boiler – This unit ensures optimum efficiency throughout the entire burn cycle by automatically and continuously adjusting the **stepper motor controlled dampers/drafts** in much the same way a **person adjusts an oxygen/acetylene torch** to produce an extremely hot, blue flame that will cut through steel. By using the CO_2% feedback from the Lambda sensor (located in the chimney exhaust), the digital Lambda control panel precisely controls the stepper motor draft controls to **ensure optimum GAS(primary)/AIR(secondary) ratios** and secondary burn chamber temperatures of 1,800-2,000 °F during the burn cycle. The chimney, however, operates at approx. 325-375°F during the same burn cycle-*please refer to the graph on page 5 which shows these "real time" operating temperature).*

Data logging chimney smoke and secondary chamber temperatures using "K" type, high temp. thermocouples

"K" type thermocouple measuring chimney smoke temperatures

"K" type thermocouple measuring secondary chamber temperatures

Lambda control also eliminates the need for a by-pass lever as is found on many of the competitive brand boilers (EKO, Biomass, Vigas, Tarm etc.). In the unlikely event the Lambda sensor should fail, a few buttons on the lambda control panel can be pressed which will allow the boiler to operate in a non-lambda mode (in this mode the primary draft opening is set to approx. 70% and the secondary draft opening is set to approx. 30%- *this is how non-lambda controlled boilers such as EKO, Biomass, Attack, Atmos, Tarm etc. operate during their entire burn cycle).*

A fire is started in the top, primary chamber of the Lambda boiler. Once it is burning (2-3 minutes) the chamber is filled with dry, seasoned wood (approx. 15-20% MC wood), the primary door is shut and off to work/play the operator goes. The Lambda sensor system greatly reduces the time consuming hassle of tending the boiler.

Fire in primary chamber – the vertical walls are wider at bottom than at top to reduce wood fuel "bridging"

Fully water jacketed secondary chamber with stainless steel afterburner

Stainless burner tube with 70 ports – as viewed from secondary chamber

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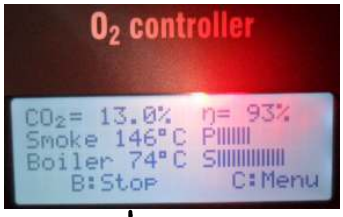
In addition, the Lambda control will automatically adjust the draft controls for different species/moisture contents of wood by the simple manual adjustment (via the lambda control panel) of the CO2% setting. Normally, for most dry, seasoned wood this is set to 13% CO_2. However, for wetter/less seasoned wood it can be increased and for dryer/more seasoned wood it can be decreased (in general, the wood must be between 15-25% MC). By doing so, a much more efficient burn cycle, lower consumption of wood fuel and much cleaner emissions are the end result.



Chimney outlet (6"dia. for 35 kw and 7"dia. for 60 kw models)

Lambda Sensor (installed in chimney exhaust)

Exhaust Fan at rear of boiler (negative draft design)

Turbulators and Heat Exchanger tubes ensure the optimum transfer of heat/BTU's from combustion temperatures to water in boiler system

Qty 7 for 35 kw
Qty 12 for 60 kw

Stainless Steel burn tube incased in (4) piece ceramic ensures complete mixing of wood gas and oxygen

Stainless Steel After Burner ensures the complete burning of gases

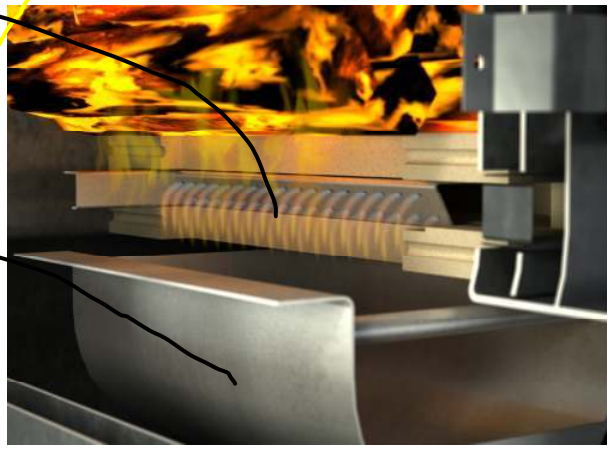
Smoke Evacuation Port greatly reduces the amount of "in your face" smoke which escapes when opening the primary chamber door

Primary Chamber where wood is heated just enough to be converted to gas

Primary Draft Control (stepper motor controlled)

Secondary Draft Control (stepper motor controlled)

Fully water jacketed secondary burn chamber results in extremely efficient heat transfer of 2,000°F temperature to water in boiler system



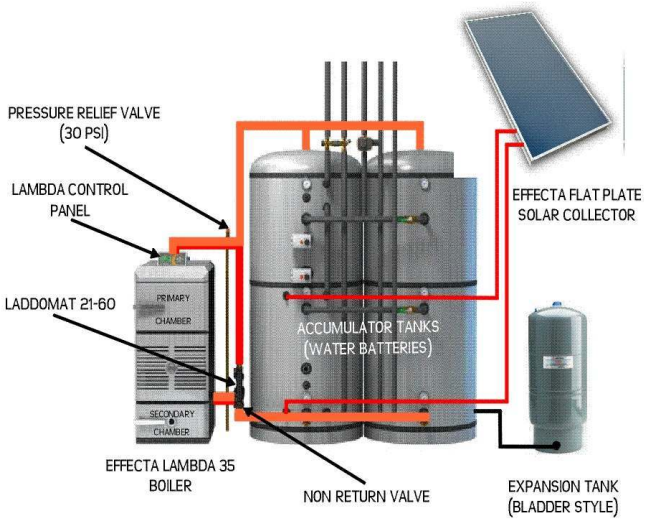
Effecta Lambda 35 kw with optional 20/30kw, 90+% efficient pellet burner

BASIC OPERATION AND COMPONENTS OF AN EFFECTA LAMBDA BOILER SYSTEM WITH ACCUMULATOR TANKS (WATER BATTERIES) AND LADDOMAT LOADING VALVE

Laddomat Loading Valve – This unit ensures the Effecta Lambda boiler operates at high temperatures, optimum efficiency and minimum emissions. The loading valve uses a series of temperature control valves and a pump. The water in the red circuit (boiler side) quickly reaches 162° F (72° C) because the red circuitry contains a very small volume of water which is heated very quickly. The firebox temperature reaches a much higher operating temperature faster because the water entering the back of the boiler is at 162 °F (72 °C) and promotes more efficient combustion of the wood fuel.

A non return valve between the accumulator tanks (water batteries) and the Laddomat loading valve prevents cooler water from the orange circuit entering the much hotter water in the red circuit during the warming cycle.

Once the red circuit is up to temperature, the loading valve gradually allows water to flow into the accumulator tank through the orange circuit *(this is vitally important for the efficient use of heat storage-without the Laddomat to ensure a precisely controlled slow flow rate, the mixing of hot and cold water is too great and does not provide for proper stratification-the hot water at the top of the tank is separated from the cold water at the bottom of the tank by a stratification layer)*. It does this in such a way as to keep the temperature in the red circuitry at approx. 162 °F (72 °C).



In the event of a power outage or pump failure, the Laddomat loading valve allows the hot water to circulate through the orange circuit by thermosyphoning, thus preventing overheating of the boiler.

Finally, the heat stresses and damage to the boiler are kept to a minimum (thus reducing thermal shock) by ensuring the boiler is always receiving hot water, regardless of the accumulator tank temperature.

Laddomat Loading Valve complete with (3) ball valves, (3) 1-1/4" unions, circulator pump, 2 piece insulated cover and (3) temp. gages

Accumulator tank – These "water batteries" accumulate and store the large amounts of BTU's generated from the highly efficient Effecta Lambda wood gasification boiler for use at a later time. By allowing the Lambda boiler to operate at "full throttle/maximum output" during the entire burn cycle the following benefits are gained/recognized:

1.) Maximum BTU energy is extracted from the wood fuel.
2.) Minimal consumption of wood fuel generates large amounts of BTU's to meet various heating loads.

**** Lambda 35kw **(122,000 BTU) boiler** can heat up to 5,000 ft when used with 1,000 gallon accumulator tank

**** Lambda 60kw **(205,000 BTU) boiler** can heat up to 10,000 ft when used with 2,000 gallon accumulator tank

3.) Emissions are kept to an extremely low level due to the 1,800°F - 2,000°F temperatures in the secondary chamber.

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4.) Extend useful/effective heating range by hours or days, especially in the spring/fall and summer when the outside temperatures are higher. With a properly engineered Lambda boiler system, **ONE burn cycle per day** (with a 1,000 gallon accumulator tank) will provide for approx. 4-6 days of DHW (domestic hot water) in the summer. In the fall and spring, **ONE burn cycle will provide** for approx. 2 days of heating and DHW. In the middle of winter **ONE burn cycle** will provide for heat and DHW for 12-24 hours. **ONE burn cycle** is 4.8 cu. ft of wood with a 35 kw Lambda boiler and 6.8 cu. ft. of wood with a 60 kw Lambda boiler.

5.) Allows for very efficient, very low emissions Effecta Lambda boiler operation "all year round", regardless of the outside air temperature. Thus, by using the Lambda boiler system "year round" **a quicker ROI (return on investment) is realized.**

6.) Allows for the easy integration of solar hot water panels into existing Effecta Lambda system with accumulator tanks.

7.) By purchasing the accumulator tanks with solar hot water panels (and all other misc. required equipment for the solar portion of the system –including labor,) a **30% Federal Tax Credit can be realized**(consult your tax advisor).

Interested in joining the fast growing family of satisfied Effecta Lambda boiler system customers in North America?

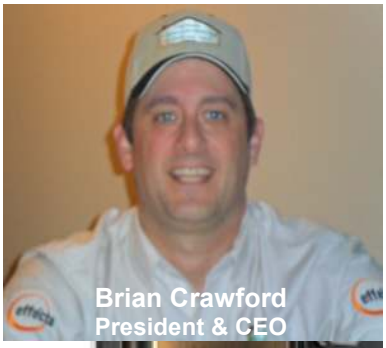
Brian C., East Jordan MI Effecta Lambda 35kw with 2 x 500 gallons (horizontal) of propane tank accumulators
*(heating a 4,000 ft^2 home/garage, J365 hot tub and DHW)****installed November, 2010 with baseboard/in-floor heat****
Bill M., East Jordan MI Effecta Lambda 35kw with 2 x 500 gallons (horizontal) of propane tank accumulators
*(heating a 5,000 ft^2 home/garage and DHW) ****installed December, 2010 with baseboard heat****
Gene M, East Jordan MI Effecta Lambda 35kw with 1 x 1000 gallons (horizontal) of propane tank accumulators
*(heating a 4,500 ft^2 home/garage and DHW) ****installed February, 2012 with forced air furnace heat****
Jim S., Cheboygan MI Effecta Lambda 35kw with 2 x 250 gallons (horizontal) of propane tank accumulators
*(heating a 3,500 ft^2 home/garage and DHW) ****installed December, 2010 with baseboard heat****
Noel F., Cheboygan MI Effecta Lambda 35kw with 2 x 500 gallons (horizontal) of propane tank accumulators
*(heating a 3,000 ft^2 home and DHW) ****installed October, 2011 with baseboard heat****
Mitch B., Branch MI Effecta Lambda 60kw with 1 x 2,000 gallons (horizontal) of propane tank accumulators
*(heating a 6,000 ft^2 home, 2,000 ft^2 garage and DHW) ****installed November, 2011 with in-floor heat****
Jon A., North Hampton NH Effecta Lambda 60kw with 1 x 2,000 gallons (horizontal) of propane tank accumulators
*(heating a 9,600 ft^2 home/garage and DHW) ****installed October, 2011 with in-floor heat****
Gerald L., Alpena MI Effecta Lambda 35kw with 2 x 500 gallons (horizontal) of propane tank accumulators
*(heating a 2,800 ft^2 home, 2,000ft^2 garage and DHW) ****installed October, 2011 with forced air furnace heat****
Luke W., Canada Effecta Lambda 35kw with 1 x 1600 gallons (vertical) of propane tank accumulators
*(heating a 3,000 ft^2 home, 2,000ft^2 garage and DHW) ****installed December, 2011 with forced air furnace heat****
Craig P., Garden City MI Effecta Lambda 35kw with 2 x 500 gallons (vertical)of propane tank accumulators
*(heating a 3,000 ft^2 home, 2,000ft^2 garage and DHW) ****installed December, 2011 with forced air furnace heat****
Pete S., Freedom NH Effecta Lambda 60kw with 2 x 1000 gallons of propane (vertical) tank accumulators
*(heating a 3,000 ft^2 home, 2,000ft^2 garage and DHW) ****To be installed Summer, 2012 with in-floor heat****
Paul F., Canada Effecta Lambda 35kw with 3 x 750 liters (vertical) of Effecta insulated tank accumulators
*(heating a 3,000 ft^2 home, DHW) ****To be installed Summer, 2012 with in-floor heat****
Ryan M., Oak Harbor OH Effecta Lambda 60kw with 2 x 1000 gallons (horizontal) of Amonia tank accumulators
*(heating a 5,000 ft^2 home, 2,500ft^2 garage and DHW) ****To be installed Summer, 2012 with in-floor heat****

AND GROWING RAPIDLY!

3rd shipment of boilers in progress

as of 2.13.2012!


Up North Energy Boiler Trailer at MREA show in Custer WI -summer of 2011-


Brian Crawford
President & CEO

"Best in Class, 90% Efficient, Lambda Controlled Wood Gasification Boilers"

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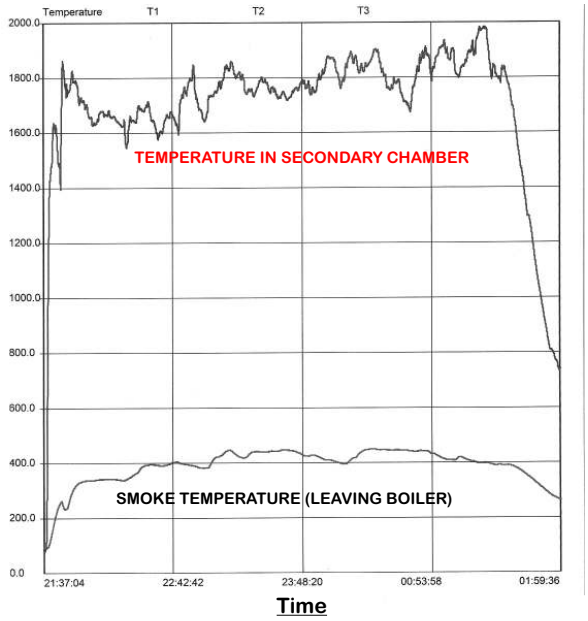
TEMPERATURE DATA FROM 4.5 HOUR BURN CYCLE (BOILER FULLY LOADED W/ WOOD) USING AN EFFECTA LAMBDA 35KW BOILER WITH 1,000 GALLONS OF THERMAL STORAGE (BOTH LAMBDA AND NON-LAMBDA MODES)

The Effecta Lambda 25/35/60kW boilers have been tested/certified/listed to UL 391, CSA B366.1 and ETL-M solid fuel burning device standards

BENEFITS OF EFFECTA LAMBDA SENSOR TECHNOLOGY:

1.) Increased, more consistent secondary chamber temperatures.
2.) Decreased chimney flue gas temperatures.
3.) Reduces harmful emissions by 400%.
4.) Greatly reduces the "tending" that is required when using non lambda controlled boilers.
5.) Allows for accurate matching of species/ moisture content of wood to proper CO2% setting to maintain optimum BTU output and lowest possible emission levels.
6.) Minimized wood log consumption..

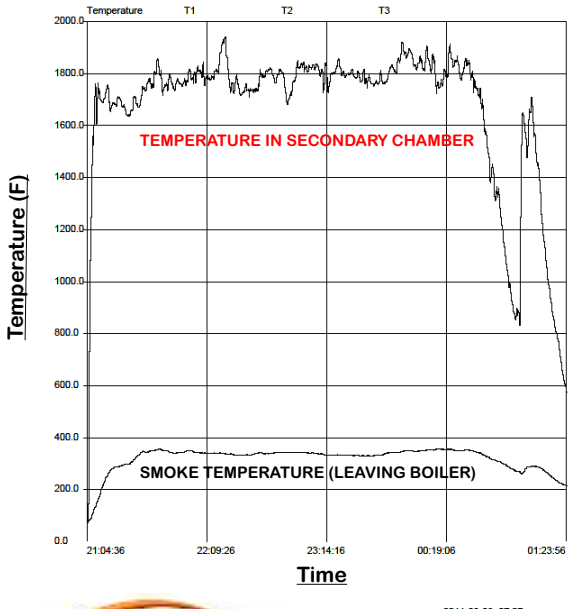
EFFECTA 35 BOILER WITH LAMBDA MODE NOT ACTIVATED



The data found on this publication was gathered using a Dent Elite Pro data logger with (2) 2,400 F thermocouples.

The Effecta Lambda boiler was operated as a closed, pressurized system (approx. 15 PSI) with the CO2% set to 13.0%. Approx. 95 lbs of 15% MC hard maple was consumed during the 4.5 hour burns

EFFECTA 35 BOILER WITH LAMBDA MODE ACTIVATED



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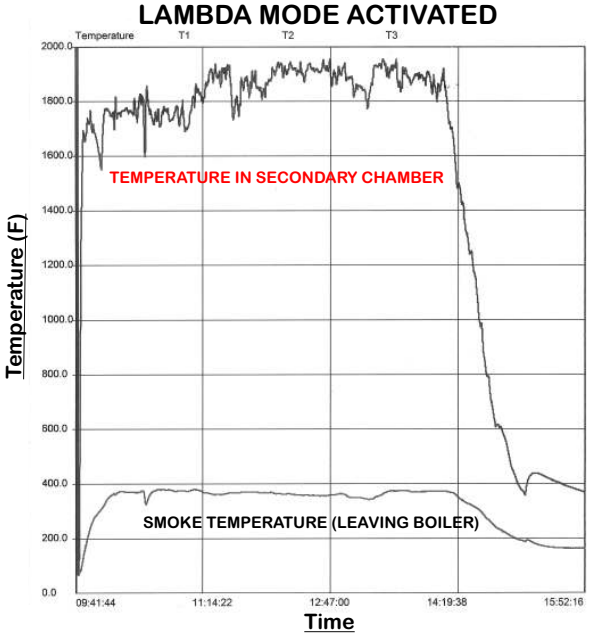
EFFECTA 35 BOILER WITH LAMBDA MODE ACTIVATED



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