

Conversion – Boilers for Beginners

Andy Hall (Forest Research)

1. The Myths...

There are still many myths associated with the use of wood burning equipment. The questions often asked are:

- “Where do you shovel the wood in then?”
- “Aren’t they dirty?”
- “Don’t they smoke all the time?”
- “Don’t they need a dump load?”
- “You mean you can modulate them?”

2. What and Why?

Equipment is predominantly European in origin but not exclusively so and there have been significant technology advances in the last 5 years.

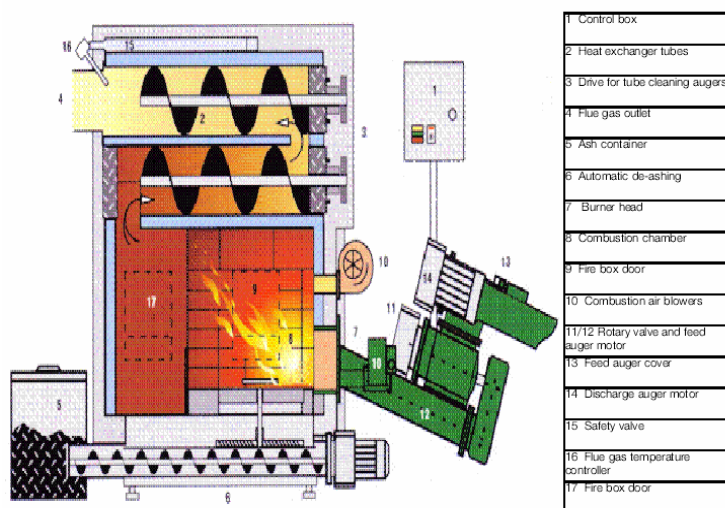
- Using the latest combustion engineering principles coupled with ‘State of the Art’ control technology that uses the widest range of low cost wood fuels.
- So that systems provide equivalent or greater levels of efficiency, reliability and convenience to that of fossil fuel machines.

The Technology...

The Primary Components and Considerations of any system are...

- **The Combustion Chamber and Heat Exchanger**
- **The control of Air and Fuel**
- **The Efficiency and any Emissions**
- **The main Features.**

Figure 2 Typical boiler features (courtesy of Heizomat GmbH)



Burner: comprises a short auger that feeds the fuel directly into the combustion zone. The type and design of the grate varies between individual manufactures. ‘Underfed grates’ are typically used with wood-fuels with moisture contents of 30% or less, ‘Overfed grates’ are used for small wood pellet burners and ‘Moving step grates’ are used for fuels with moisture contents of 30% to 60%.

Boiler: these are conventional boilers similar to those used for gas or oil fired systems. They comprise either a simple water jacket or multi-pass fire tube positioned either horizontally or vertical. The boilers are highly efficient with typical efficiencies of 80% to over 90% for woodchip and wood pellet systems. There is a tendency for fly ash to accumulate in the fire tubes, especially those set in a horizontal position, which thus require cleaning at regular intervals dependent upon the fuel quality.

The larger systems are fitted with cyclone separators to collect any fly ash passing through the boilers and into the environment. Many boilers are also fitted with flue gas recirculation, which helps to control combustion temperatures and reduce NO_x formation.

3. Efficiency and Emissions...

The efficiency of the process is measured by the amount of CO in the exhaust gases. The aim of combustion is to ensure a maximum amount of CO₂ without any non-combusted gases, CO, in the exhaust gases.

- O₂... between 5 and 8 %
- CO₂... (given the above) the average would be 16 to 16%
- CO... less than 100 ppm
- NO₂... temperature dependant (thermal NO₂ or incomplete combustion)
- Exhaust gas temperature... 150°C before the exhaust gas fan.

For reference:

- EN 303-5 or Equivalent as tested by an ISO17025 Accredited Laboratory
- Class 3 efficiency as minimum - (73% - 82%), achievable (85% - 95 %+)
- Submission for Clean Air Act Smoke Control Area Exemption through DEFRA/Netcen (BS PD 6434) - <http://www.uksmokecontrolareas.co.uk/applianceprocedure.pdf>

4. Features...

The key features to look for in any system are:

- Lambda Control
- Exhaust Gas Recirculation
- Automatic Tube Cleaning
- Automatic Ignition
- Automatic De-ashing
- Intuitive HMI
- Remote access facilities
- Boiler and Fuel Handling single source of supply

5. On-Site Fuel Handling...

Often overlooked but an essential element of any installation is on-site fuel handling. Considerations include:

- Fuel Store Size
- Access for Vehicles
- Delivery into Fuel Store
 - Tipping
 - High Speed Conveyor
 - Dump Store
 - Ro-Ro Bins
 - Pneumatic and Big Bag

6. Fuel Supply Chain...

Again often overlooked but is a major cost component and in some cases a considerable barrier to subsequent development.

- Distance Limitation
- Fuel Specification Compliance (CEN 335)

- Long Term Security of Supply
- Cost and Contract
- Partnership

7. Summary of markets and fuel requirements...

Market	Fuel Type
Domestic Market	Seasoned logs or pellets
Commercial heat market	Wood chips or pellets
Power generation	Hog fuel
Co-firers	Traditionally sawdust or pellets but moving towards hog fuel
Small scale CHP	Technology determines fuel spec

Acknowledgements:

Mike Pitcher – WEBs

Keith McKendrick – Wood Energy Ltd