Biomass Boiler Information

Rev A (Variation) 19th April 2024

In common with other types of combustion appliances, biomass boilers are potentially a source of air pollution. Pollutants associated with biomass combustion include particulate matter (PM10/PM2.5) and nitrogen oxides (NOx) emissions. These pollution emissions can have an impact on local air quality and affect human health. It is essential that any new biomass boilers meet certain emission control requirements in order to protect local air quality.

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1. Development Details

a) Planning Application Reference	**tbc**
b) Name of Site	**Sauchen Tree**
c) Address where boiler(s) will be located	**Sauchen Tree, New Aberdour, AB43 7LN**
d) Person completing form	Kevin O'Brien Architects
e) Contact telephone number	**01779 238020**

2. Particulars of the Boiler

This information on the basic design of the system will help us assess the emissions performance. Biomass boilers often produce relatively high emissions when lightly loaded, hence the question regarding an accumulation tank (heat store). The boiler manufacturer and/ or installer should be able to help you provide this information.

f) Describe the proposed biomass boiler including make, model, manufacturer, thermal capacity (kw/MW), efficiency, maximum rate of fuel consumption (kg/hr or m^3/hr).
Dragon D220 Biomass Boiler 220kW; 86% efficiency see RHI Cert for fuel consumption
g) Describe the boiler combustion system and how combustion will be optimised and controlled.
The Dragon boiler has been designed and constructed to burn biomass fuel. Fuel is loaded through a main front door into a furnace chamber. Combustion is achieved by manually lighting the fuel within the furnace chamber and kept alight by forcing air into the same area. The emissions leave the furnace through the heat exchanger tubes and eventually into a back box and up into a twin wall flue located at the rear of the boiler. The fire inside the combustion chamber heats a jacket of water built around the furnace which is circulated by a shunt pump located on the rear of the boiler. The same water is pushed into the heat exchanger area which is heated further by the hot gases. The boiler has a fan placed on an air box at the rear of the boiler. This allows air to be forced underneath the

fuel (to aid combustion) and also over the top of the fuel to burn secondary gases. This manual adjustment of the air flap on the rear of the boiler increases the efficiency of the Dragon by ensuring that the fuel is burned effectively before the emissions form the fuel pass into the heat exchanger. The combustion chamber is built from boiler plate 10mm in thickness. The use of boiler plate ensures that the variable temperatures inside the furnace do not have a detrimental effect on the longevity of the Dragon. The water jacket is 50mm wide around the main furnace cylinder. There is approx 1100 litres of water in this area, which is then completely insulated using a high density insulating material. At the front of the boiler is the main door which lined with refractory cement designed to withstand temperatures of around 1600 degrees celsius. The outside of the door is then insulated with rockwool. The heater is then framed and covered. Then painted with several layers of primer, undercoat and a specially designed, hard-wearing top coat finish. The boiler uses a heat exchanger system to use the hot gases from the fuel to heat an additional water jacket. This ensures that the emissions leaving the main furnace at 700+ degrees are converted into hot water and the temperatures entering the flue are reduced to less than 200 degrees. This has the effect of reducing the NOx and the heat exchanger also helps to capture any remaining particles of unburned fuel. This residue must be cleaned on a regular basis. As the remaining gases leave the heat exchanger, they enter a steel fabricated back box before entering the twin wall stainless steel flue. The back box contains a removable hatch to enable easy maintenance of the back box and flue.
h) Describe the fuel feed system.
Fuel is manually fed into the Dragon through the large main door. The Dragon should ideally be loaded once a day and at a regular time. The control panel can tell the user when to load the boiler by using one of several options, such as a temperature gauge, a flashing beacon or an e-mail messaging service can be incorporated into the controls.
i) Provide details of the abatement equipment in place for controlling particulate matter (fly ash) emissions.
Ash is likely to build up in the main furnace area and the heat exchanger tubes. This has to be cleaned manually on a regular basis to ensure the efficiency of the boiler. Cleaning tools are supplied. Residue is also likely to build up in the back box and flue which must also be cleaned seasonally to ensure that emissions are not allowed to build up in the boiler. When ash is removed, it should be collected within a steel container.

j) How does the biomass boiler deal with variable heat loads – is the boiler linked to an accumulation tank?
The Dragon should be connected to an accumulator tank which will ensure that there is an even distribution of heat distributed from a variable fuel source such as batch biomass.
k) Is the biomass boiler an exempt appliance in accordance with the Clean Air Act 1993? If yes provide evidence to demonstrate the biomass boiler has been tested and certified as an exempt appliance (for example a link to the appliance on the UK Smoke Control Areas website https://smokecontrol.defra.gov.uk/appliances.php?country=scotland)

The boiler is not an exempt appliance but not in a smoke control area

3. Boiler Operation and Maintenance

System efficiency and emissions performance very much depend upon regular maintenance. Your installer should be able to recommend a suitable maintenance schedule.

l) Describe arrangements for cleaning and de-ashing the boiler.
Boiler to be cleaned and de-ashed once a week manually using supplied tools. The heat exchange tubes will be cleaned weekly by brushing them with the wire bush. The boiler will be left to cool down before de-ashing and heat exchange tubes cleaning. Cooled ash will be collected into the steel container. Boiler operative will monitor levels of ash and dust deposits in the boiler while loading the boiler and decides if it needs cleaning more often. Boiler stack will be inspected weekly during the boiler cleaning and swept if necessary.
m) Provide details of the maintenance schedule associated with boiler, abatement equipment and stack. This should include frequency of boiler inspection and servicing by a trained boiler engineer.
Daily inspections including: - Check for build-up of ash in the chamber and clearing if necessary - Check the blower bars clear of ash and debris - Check the heat exchange tubes are not blocked - Check if Doors are operating as normal - The pumps for faults - Leaks on the pipework and safety pressure relief valve - Control panel operation and water temperature reading - Burner fan working and free from blockages - Heat meter operational - Area around the boiler is clear of ash and debris **Weekly inspections:** - Clear the ash of the chamber - Remove and check the blower bars - Scrape and brush the heat exchange tubes - Clear the chimney box - Check the flue for blockages and sweep if necessary

- Check the burner fan for dust and debris
- Check the main pumps
- Check the shunt pump and flow switch operation
- Grease the door bearings

6-month inspections:

- Clear/Scrape the chamber walls
- Check the blower bars manifold for blockages
- Thoroughly clean/scrape the chamber
- Sweep the chimney
- Check for rust, clear and re-paint if necessary
- Check electrical connections
- Check the pipe lagging
- Check the door rope

Boiler to be serviced by biomass engineer or other competent engineer annually. Service includes checking for faults, thoroughly inspecting whole system components, repairing/replacing faulty components, cleaning the boiler, sweeping the flue, removing the rust and repainting surfaces if needed, advising customer about operational faults, etc.

n) Describe how incidences of boiler or abatement system failure are identified & mitigated.
Daily physical checks following the maintenance schedule Control panel should be alarmed to highlight occurrences above and below set points for flue and water temperatures. These can also be linked to a modem for online or text messaging monitoring.

4. Boiler Stack Details

The design of the stack greatly affects how pollutants produced in the boiler disperse over the surrounding area. Where the area is heavily built up, or has existing air quality issues, dispersion becomes more complicated and a computer modelling technique known as dispersion modelling may be required. Your installer should be able to provide most of the details and make a calculation on stack height and design. When dispersion modelling is required you or your installer may need to engage a specialist consultant.

o) Identify the height of the boiler exhaust stack above ground.
7.1 m
p) Identify stack internal diameter (m).
0.3 m ID
q) Provide maximum particulate matter and nitrogen oxides emission rates (mg/m^3 or g/hr) to

standard reference conditions (6% oxygen, 273K, 101.3kPa).
Refer separate RHI certificates

r) Identify the exhaust gas efflux velocity (m/s).
3.4 m/s
s) Provide the grid reference of boiler exhaust stack.
389736E, 863433N approx

5. Fuel Details

Emissions from a biomass boiler depend greatly on the type and quality of the fuel used. Reasonable guarantees are therefore needed that the fuel is compatible with the boiler, is of a high quality and that quality will be assured for a reasonable period of time. Your fuel supplier and installer should be able to provide this information.

t) Describe the fuel specification including origin, type of wood (chips, pellet, briquettes), nitrogen, moisture, ash content (%).
Cereal straw bales
u) Does the fuel comply with European or equivalent fuel quality standards such as CEN/TS 335 or ONORM?
Boiler will be registered to RHI which requires fuel to be specific moisture content and quality as per RHI emission Certificate. The fuel log will be kept up to date. Fuel will comply with CEN/TS 335 (which been developed into CEN/TS 14961)
v) Describe what fuel quality control procedures will be adopted to guarantee constant fuel quality from your supplier.
Cereal straw bales are relatively stable in terms of their moisture content
w) Provide evidence to demonstrate that the biomass boiler combustion system is applicable to the fuel specification.
The Dragon boiler has been designed to accept all biomass products. It will perform better or worse depending on the moisture content of the fuel and the air flow around the fuel inside the burning chamber. The information is on the emissions certificate.
x) Identify where and how fuel will be stored on site (e.g. bunker or silo).
Biomass Store
y) Describe how fuel will be unloaded from the delivery vehicle into the storage facility and what control measures will be in place to reduce particulate matter emissions to atmosphere.

Fuel Will be unloaded using HIAB lorries or loading equipment available on site.

6. Building Details

The height and distance of neighbouring buildings will determine their exposure to emissions from the biomass boiler, and therefore the height of the stack needed. Your architect should be able to provide this information.

z) Record the distance of adjacent buildings from boiler exhaust stack.
As noted on plans
aa) Record the height of adjacent buildings from boiler exhaust stack.
As noted on plans
bb) Record the dimensions of building to which the boiler exhaust stack is attached.
No applicable
cc) Indicate the distance from the boiler exhaust stack to the nearest fan assisted intakes and openable windows.
Over 100m (residential) 34.5m to farm shed