Scotts OF THRAPSTON EST. 1920

Supporting Document for the Application for a 'Part B' permit with further details about the MWE199 Biomass Boiler and its operation.

# APPENDIX 2

## 'PART B' PERMIT APPLICATION

Date: Nov 2023

## BACKGROUND

Established for over 100 years, Scotts of Thrapston manufacture a wide range of timber buildings and products. All timber products are uniquely designed to each customers' requirements.

As part of the production process waste wood off cuts and sawdust is produced. This is processed and used as a fuel in a highly efficient biomass boiler system, which has the advantage of cutting down on fossil fuel usage and disposal of waste to landfill.

Scotts of Thrapston have a 199kWth biomass boiler installed to generate space heating for the factory. It has been determined that the plant falls below the 50kg/hr threshold that requires a Part B Permit. However, as it is a directly associated activity to their current Process Activity Permit, a variation is being applied.

It is intended for the boiler to burn fuel as classified under EWC 03 01 05. All the waste wood is generated on site so there is full transparency of the fuel used. According to EPR Technical Note PG5/1(21) it is below the threshold of 90kg/hr and therefore no monitoring or extractive testing is required, only the observation of daily smoke emissions.

For the purposes of this permit application, we are referring to EPR Technical Note PG5/1(21). This is to ensure we are meeting any new/forthcoming legislative changes.

## KEY FEATURES OF MWE199

The MWE199kWth biomass boiler range features include the following:

### BIOMASS COMBUSTION SYSTEM

⇒ **Suitable for a wide range of fuel types:**
- Wood chip
- Pellets
- Wood production factory residues (MDF / Chipboard)

⇒ **Boiler protection:**
Protected by a mains fed cold water coil integrated within the boiler, in the event of a power failure, the system will automatically cool the boiler by dissipating the heat to a drain in order to prevent damage.

⇒ **Two stage hybrid Combustion grate:**
- First stage solid retort
- Second stage fuel burnout zone
- Independent two stage primary air control
- Sectional grate elements are made from a high temperature cast chromium alloy
- Water cooled grate support

The regulated combustion air supply flows around the combustion chamber and under the grates, cooling the surfaces and returning the energy gained by pre-heating the air to four independently adjustable air stages within the combustion process, increasing efficiency.

⇒ **Fuel is supplied by a variable speed air cooled stoker with burn back provision:**

- Fuel barrier
- Controlled negative pressure inside the combustion chamber
- Thermostatic prevention system
- Direct acting thermostatic water dousing system
- Rotary valve fire choke

⇒ **Combustion chamber**

- Stoichiometrically designed three stage system
- Completely lined with refractory brickwork
- Automatic ignition, automatic heat exchange cleaning and automatic de-ashing. This minimises downtime and increases boiler efficiency
- Fully modulating microprocessor-controlled combustion combined with Lambda O2 sensor
- Detects variations in fuel quality by automatically adjusting the air intake and/or fuel supply
- Provides optimal combustion efficiency with very low emissions
- Boiler fire tubes within the heat exchanger can be fitted with pneumatic air blast nozzles
- Gives and maintains optimum boiler efficiency whilst reducing the need for manual cleaning
- Combustion grate with vibrate assist

⇒ **Controlled flue gas recirculation (FGR)**

- Regulates combustion temperature and fuel-to-air ratio
- Prevents over temperature in the combustion chamber
- Increases the lifespan of the grate and ceramics
- Reduces risk of clinkering and deposit formation
- Lowers exhaust O2 level which improves boiler efficiency
- Lowers NOx emissions

Further description can be found in Operation Manual for MWE range Section 1.2.

## ABATEMENT

⇒ **Highly Efficient Cyclone**

Removes particulates from the flue gas, ensuring compliance with Emission Limit Values in EPR Technical Note PG5/1(21).

- Operation: The I/D Fan will draw the fumes and heat from the combusted material through the heat exchange then through the cyclone. The cyclone will then separate whatever ash particles remain depositing them in the grit bin underneath. The remaining fumes are then pulled through an intermediate flue system into the I/D Fan and then expelled out through the main flue and into atmosphere.

**Induced Draft Fan**

**Cyclone**

## CHIMNEY

⇒ **Chimney**

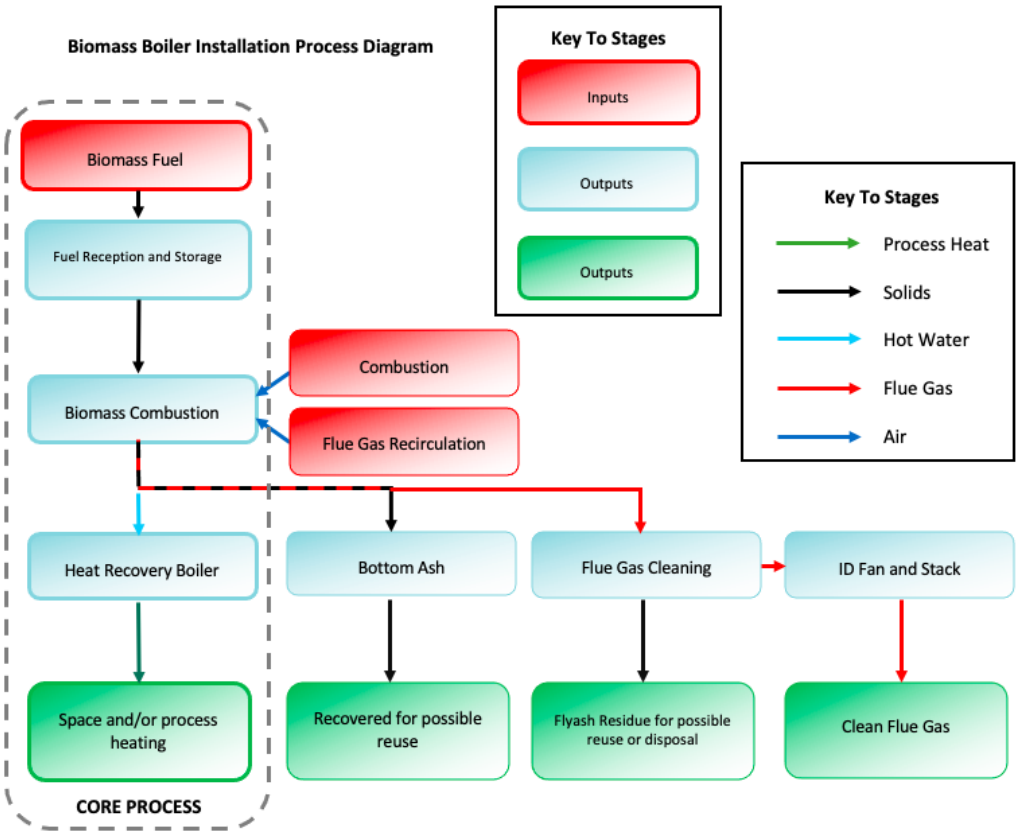
- Double Skin Stainless Steel Flue designed for efficient dispersion of flue gasses.
- Top Stub
- Roof Sealing Kit and/or Wall Brackets
- All necessary supports, parts & fixings

## KEY ACTIVITIES OF MWE199

The key activities associated with the operation of the MWE199 biomass boiler are as follows:

- Fuel reception, storage, and handling
- Combustion of biomass fuel with associated recovery of heat for distribution to the factory
- Flue gas clean-up to remove particulates
- Emission to atmosphere via a chimney
- Collection of bottom ash and fly ash for subsequent use or disposal

The Talbott's MWE199kWth biomass boiler has been designed to comply with the principles of Best Available Techniques (BAT) for the combustion of biomass fuels and incorporates a range of monitoring and control features to optimise combustion and the associated recovery of thermal energy from the biomass fuel, while minimising pollutant emissions and the generation of solid residues. The appliance has been fully tested by an EN17025 test house and presented with an RHI emissions certificate reference P3617/C005(B) for a variety of biomass fuels. A copy of which is included with this document. The activities associated with the operation of the biomass boiler facility are shown schematically in the following Process Flow Diagram.




## FUEL RECEPTION, STORAGE AND HANDLING

Wood offcuts are shredded and automatically transferred to the fuel storage silo. Any sawdust produced is automatically extracted and fed into the biomass boiler plant.

Fuel is metered into the combustion chamber of the MWE199 biomass boiler by means of a screw auger that is driven by an invertor-driven motor that modulates its speed according to the demand for heat from the biomass boiler control systems. Combustion air is delivered from beneath the grate in varying proportions, along the length of the grate by a series of dampers. The air to fuel ratio is varied along the length to provide optimum conditions for combustion of the biomass fuel.

Flue gas recirculation (FGR) is incorporated into the design of the biomass combustion system and is introduced to maintain the combustion temperatures below critical values to avoid excess thermal NOX formation and to prevent ash fusion and clinkering. The flue gas recirculation is fully modulating to provide the correct response over the boiler control range without excessive loss in efficiency.

Fuel is introduced to the top of the inclined grate where moisture is driven off and the temperature is raised to ~350ºC where devolatilisation of the biomass fuel begins to occur. The fuel continues to pass down the inclined grate and the volatiles that are released burn above the bed of fuel and pass into the secondary combustion chamber, while the resulting char passes on down the grate where it is exposed to higher concentrations of oxygen (higher air to fuel ratio) to promote complete combustion of the less reactive char. At the end of the grate the fully burnt-out, bottom ash residue falls into an ash quench chamber prior to being transferred to an ash collection bin by a screw feeder. Thermal energy associated with the hot combustion gases is recovered in the convective smoke tube section of the boilers to

produce hot water at ~90ºC, which is then introduced into the heating circuit and returned to the boiler at a temperature of 70 ºC.

The internal dimensions of the combustion chamber provide a residence time of more than two seconds based upon a volumetric flow rate of the flue gas generated by the combustion of the biomass fuel. Combustion gases exit the boiler and pass through a filter where most of the entrained particulates (fly ash) are removed prior to discharge of the flue gas to atmosphere via the chimney.

Fly ash collected from the base of the filter falls into a hopper from where it is collected for subsequent disposal. The chimney has been designed to provide effective dispersion of pollutant emissions produced by the combustion of the Grade B wood chip fuel. The height of the chimney has been confirmed by undertaking D1 flue height dispersion calculations, along with a H1 environmental assessment. Copies of the reports will be provided with this application.

## PROCESS CONTROL

The boiler control system provides total combustion management ensuring high reliability and low emissions. This is achieved by a lambda control loop (oxygen trim) through the PLC unit along with real time feedback of the furnace, post furnace and flue gas temperatures. The primary and secondary fans are inverter driven allowing optimum combustion to be achieved for various load requirements, and variability in the proportions of sawdust in the fuel mixture.

Further information about monitoring boiler performance, including lambda control loop can be found in section 2.5 of the Operation Manual for MWE Range.

## COMBUSTION MANAGEMENT

All aspects of the combustion of the fuel are managed by the biomass boiler's Programmable Logic Controllers (PLC). Fuel is called for from the fuel store via demand to satisfy the temperature set within the PLC.

Fuel is supplied via automated control, managed by a series of infra-red sensors mounted in the conveyor and fuel hopper. This provides a constant controlled supply of fuel to the hydraulic loading system. The rate of the fuel feed is governed by pre-set cycle times, programmed into the PLC control system. The hydraulic fuel feed 'pusher' loads the pre-determined quantity of fuel into the combustion chamber's 'loading plate'. This allows the process of pre-combustion drying/evaporation to start prior to the fuel being pushed onto the moving grate. The fuel is subsequently moved down the grate delivering it to the point of maximum pyrolysis/gasification, and the primary air addition first and second stages.

The speed of the moving grate is governed by pre-set times programmed into the PLC, as is the primary air flow rate to the combustion chamber. A zirconia probe situated within the combustion chamber provides information to the PLC to "trim" the oxygen concentration (excess air levels) to provide efficient combustion conditions at all times. Secondary and tertiary air speeds are controlled by the flue gas oxygen monitoring lambda probe.

Combustion management is achieved through furnace and post furnace temperature monitoring.

Further information about monitoring boiler performance, including the boiler's PLC can be found in section 2.5 of the Operation Manual for MWE Range.

## POLLUTION CONTROL

Flue gas recirculation provides additional control of emissions of oxides of nitrogen (NOX) from the combustion process and prevents excessive temperatures occurring on the grate which might cause damage to component parts, that could interfere with the combustion air flow through the grate and the bed of burning fuel.

Further information about fuel settings, including re-circulation control can be found in section 2.6 of the Operation Manual for MWE Range.

The MWE199 biomass boiler is equipped with a filter for abatement of particulate emissions emitted by the combustion of the biomass derived from waste wood fuel. Each stream is taken through the multi-cyclone and ducted to the chimney. More info can be found in this document under the 'Abatement' section.

The optimisation of combustion conditions by the MWE199 boiler's PLC control system ensures that emissions of carbon monoxide and VOCs are minimized at all times. The formation of both pollutants is promoted by inefficient combustion conditions.

## ABNORMAL OPERATING CONDITIONS

The operation of the MWE199 biomass boiler will be closely monitored and controlled and the likelihood of abnormal operating conditions arising, that might give rise to unintentional releases, is remote. The PLC system detects deviations from standard operating conditions and triggers a visible and audible alarm on the control panel. The boiler control system is able to indicate a low alarm condition for small deviations which would not have a significant impact on emissions, and a high alarm condition for large deviations which could impact significantly on emissions. Under the low alarm condition, the PLC controller will alert the operator, but will continue operating. In the event that the low alarm persists without an operator responding within a defined period (typically between 4 to 24 hours depending upon severity of the alarm), then the PLC controller will automatically shut down the boiler and lock-out to prevent automated restart. Under high alarm condition, the boiler will immediately shut down in a controlled manner as quickly as possible and will then lock-out to prevent automated restart.

Both high and low alarm conditions operate independently of the operator notification, which is a secondary activity. Consideration is being given to setting up a system that will send an SMS message to operational staff in the unlikely event of abnormal operating conditions arising. Operational staff would be able to dial in remotely to the system to look at what the issue is and respond accordingly. Under this highly unlikely scenario of abnormal operating conditions, higher than normal concentrations of carbon monoxide and VOCs may occur in the emissions to atmosphere, this is due to conditions of inefficient combustion on the grate (the most likely abnormal operating condition that could occur). The impact of these elevated pollutant concentrations will be minimal in the vicinity of the site due to the height of the chimney and the effective dispersion that it provides.

Abnormal conditions are only likely to occur for short periods of time as the high and low alarm shutdown sequences will ensure that the condition does not persist unnecessarily. Any short-term transient peaks in ground level pollutant concentrations that may arise during abnormal operating conditions are unlikely to be a significant threat to the health of people living and working nearby.

More information on the alarms and resolutions can be found in section 2.7 of the Operations Manual for MWE Range. There is also a full fault list with descriptions in section 2.8 including the abnormal operating temperatures.

## FUGITIVE EMISSIONS

The MWE199 biomass boiler is a fully enclosed unit and operates under slight negative pressure which eliminates the potential for fugitive emissions of combustion gases from the boiler. Accordingly, there are no sources of fugitive emissions associated with the operation of the MWE199 biomass boiler that are likely to affect neighboring properties.

Minor quantities of dust that may be generated during the reception, storage, and handling of the wood waste fuel, will be contained primarily within the fuel storage area and the building housing the boiler. Any airborne dust that may migrate from the fuel reception area will be minimal and will not travel far due to its relatively coarse particle size, which will result in deposition being restricted to within the confines of the site boundary.

## PREVENTATIVE MAINTENANCE

Scotts of Thrapston will operate a system of preventative maintenance on the MWE199 biomass boiler to ensure that its operation is optimized at all times, minimizing the potential for unintentional releases to occur. As part of their normal duties, operational staff will undertake a daily inspection of the installation to look at obvious signs that maintenance of equipment is required. Management procedures will be prepared to inform staff of their responsibilities and will also involve recording any findings from the daily inspection process. The preventative maintenance procedures recommended by Talbott's will be incorporated into the operation procedures of the MWE199 biomass boiler. A robust servicing contract with the manufacturers of the plant will also be put into place. A copy of the operating manual for the appliance is appended to this document.

Any bottom ash, slag or dust will be handled and disposed of by an appropriate method or licensed carrier.

Further information about servicing and maintenance can be found in section 3 of the Operation Manual for MWE Range.

## ENCLOSURES:

RHI emissions certificate, Talbott MWE 199 Boiler Data Sheet, Operations manual for MWE Range

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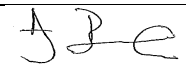
Non-Domestic Renewable Heat Incentive

www.ofgem.gov.uk/ndrhi

22 JUN 2018

# Emissions Certificate

In order to accredit any biomass boiler or stove applications received for the domestic or non-domestic Renewable Heat Incentive (RHI) schemes, Ofgem must be satisfied that a valid emissions certificate exists for the specific model in the application (or alternatively for the non-domestic RHI, an environmental permit for the site). This template incorporates all information required to demonstrate that the tested plant meets the air quality requirements of the RHI. It must be fully completed and issued by a testing laboratory in order to be a valid certificate.

| **1. TEST HOUSE** | |
|---|---|
| a) Name and address of the testing laboratory that has carried out the required tests and issued this certificate *<br>**if different, include details of both* | **<u>Environmental Compliance Limited</u>**<br>Unit G1, Main Avenue<br>Treforest Industrial Estate<br>Pontypridd, CF37 5BF |
| b) Name and signature of the person authorised by the testing laboratory to issue the certificate | Name: **Andy Barnes**<br>Signature:  |
| c) Date of issue of this certificate, together with certificate reference number for this certificate<br>**Please see Note A* | Date: **05/10/2020**<br>Certificate reference number:<br>**P3617/C003(B)**<br><br>*Optional:*reference number of original test report on which this certificate is based:<br>**P3617 R001** |
| d) If the testing laboratory that has carried out the required tests is accredited to BS EN ISO/IEC 17025:2005, date of accreditation and accreditation number<br>*(if testing conducted on or after 24 September 2013, the testing laboratory **must be** BS EN ISO/IEC 17025:2005 accredited at the time of testing)* | <u>Initial Registration:</u> United Kingdom Accreditation Service since: **16 July 2004**<br><br><u>Current Certificate:</u><br>**30 March 2020**<br>Accreditation number:**2499** |

| **2. PLANT -** *Please see Note B* | |
|---|---|
| a) Name of the plant tested | Talbotts Biomass Energy Systems Ltd. |
| b) Model of the plant tested*<br>**Please ensure this is the same as in the manufacturer's documentation and boiler nameplate* | Talbotts MWE 199<br>(Serial Number MWE 019) |
| c) Manufacturer of the plant tested | Talbotts Biomass Energy Systems Ltd. |
| d) Installation capacity* of the **tested** plant in kilowatts (kW)<br>**The total installed peak heat output capacity* | 199 kW |
| e) Is the plant a manually stoked, natural draught plant? (without a fan providing forced or induced draught) | NO |
| f) (i) Date the plant was tested*<br>(ii) Please confirm that NOx and PM have been tested on the same occasion<br>**This is in reference to the emissions testing for PM and NOx, not any wider range of tests. A specific date is required. Please provide the date of test performed at ≥85% of the installation capacity.*<br>*If more than one model has been tested or testing has been conducted on different dates for different fuels, please list each date with details.* | *29/06/2018*<br>YES |
| g) Please list all the plants in the type-testing range* of the tested plants to which the certificate applies, if any.[1] Please include the **installation capacity** of each model.<br>**This must follow the ratio rules:*<br>*If the smallest plant in the range is 500kW or less, the largest plant in the range can't be more than double the smallest.*<br>*If the smallest plant in the range is over 500kW, the largest plant in the range can't be more than 500kW greater than the smallest.* | MWE 199 |

[1] The type-testing approach enables testing laboratories to provide assurance that all boilers in a given range meet the air quality requirements, without needing to specifically test each boiler.

| **3. FUELS** | |
|---|---|
| a) Types of fuels used when testing<br>*(Where relevant, the fuel should be classified according to EN303-5, referencing the relevant EN14961 standard for **specific classification** (superseded by EN17225). We don't expect broader categories such as 'beech'.* | *Wood Chips EN14961-4, Class B1*<br><br>*Wood Chips EN14961-4, Class B2 including Melamine Faced Chipboard*<br>*(by products and residues from wood processing)*<br>*Sawdust according to EN14961-1 (Table 1) 1.2.1, M20, A3, 4.4kW/kg (Chemically untreated wood by products and residues)* |
| b) Based on the testing, list the range of fuels that can be used in compliance with the emission limits of 30 grams per gigajoule (g/GJ) net heat input for particulate matter (PM), and 150 g/GJ net heat input for oxides of nitrogen (NOx)<br>*(Where relevant, the fuel should be classified according to EN303-5, referencing the relevant EN14961 standard for **specific classification** (superseded by EN17225). We don't expect broader categories such as 'beech'.* | *Wood Chips according to EN 14961-4 Class B2, M35, (By products and residues from wood processing) including chipped wood waste, MFC, MDF, Chipboard, Softwood, Particleboard, OSB, Plywood and Hardwood.*<br><br>*Sawdust according to EN14961-1 (Table 1) 1.2.1, M20, A3 4.4kW/kg (Chemically untreated wood by products and residues)*<br><br>*Wood Chips according to EN 14961-4 Class B1, M35,* |
| c) Moisture content of the fuel used during testing. (If multiple fuel types have been tested state all.) | *Sawdust – 21%*<br>*Wood Chips Class B2 (MFC) – 21%*<br>*Wood Chips Class B1 – 21%* |
| d) Maximum allowable moisture content* of fuel that can be used with the certified plant(s) that ensures RHI emission limits are not exceeded.<br>**This value may be obtained from ranges specified in relevant EN14961 standard for specific fuel classifications or EN303-5 when not applicable. Different fuel types should state different maximum allowable moisture contents.* | *Sawdust – 21%*<br>*Wood Chips Class B2 (MFC) – 35%*<br>*Wood Chips Class B1 – 35%* |

| **4. TESTS** | |
|---|---|
| Confirm which requirements the emissions of NOx and PM have been tested in accordance with. **Either 4a or 4b must be confirmed to be a valid RHI certificate.** | |
| a) **Was the testing carried out in accordance* with all of the provisions relevant to emissions of PM and NOx in either BS EN 303-5:1999 or BS EN 303-5:2012?**[2] **It is **not** a requirement that the tested plant must be within the scope of one of these standards, as long as the test lab can confirm that **all of the relevant provisions** were followed appropriately* | **n/a – (see 4b)** |
| b) **Was the testing carried out in accordance with all of the following requirements?** (i) - EN 14792:2005 in respect of NOx emissions - EN 13284-1:2002 or ISO 9096:2003 in respect of PM emissions[3] | **Yes** |
| (ii) emissions of PM represent the average of at least three measurements of emissions of PM, each of at least 30 minutes duration | **Yes** |
| (iii) the value for NOx emissions is derived from the average of measurements made throughout the PM emission tests. | **Yes** |
| c) Please confirm the plant was tested at ≥85% of the installation capacity of the plant. | **Yes** |
| d) Please confirm the test shows that emissions from the plant were no greater than 30 g/GJ PM and 150 g/GJ NOx. | **Yes** |
| e) Measured* emissions of PM in **g/GJ** net heat input **This average value should be from the test confirmed in 4c Results from partial load tests are not required. This value must be in the specified units.* | **25.72** |
| f) Measured* emissions of NOx in **g/GJ** net heat input **This average value should be from the test confirmed confirmed in 4c. Results from partial load tests are not required. This value must be in the specified units.* | **131.31** |

[2] BS EN303-5:1999 and 2012 explain what should be measured and when.
[3] These standards explain how to make the PM and NOx measurements.

**Note A**: If details from a previously issued certificate or an original test report are being transferred to this RHI emission certificate template, please note that this document must be **issued by the testing laboratory** as a separate certificate. The issue date and certificate reference number should be in relation to *this* certificate produced using the RHI template, not the issue date and reference number of the original certificate or test report.

**Note B:** If you are including multiple tested plants on one certificate, please ensure that all sections are completed for each tested plant, and are laid out such that it is clear which details relate to which tested plant. If a type-testing range is included as well, please show clearly which type-testing range relates to which tested plant(s), following the type-testing range ratio rules outlined in 2g.

enquiries@talbotts.co.uk
(+44) 01785 813 772

# Talbott MWE 199 Boiler Data Sheet

## Boiler Specification

| | |
|---|---|
| Max Output (kW) | 199kW |
| Operating Range | 30%-100% |
| Max Flow Temp (°C) | 82 |
| Max Working Pressure (bar) | 3.5 |
| Max Test Pressure (bar) | 5.25 |
| Safety Valve Pressure (bar) | 3.5 |
| Noise Level (dB) | 73 |
| Air Volume m³/hr @ 150°C | 776 |

## Connections

| | |
|---|---|
| Flow / Return connection (inch) | 2.5 |
| Pressure Relief connection (inch) | 1.0 |
| Grate Cooling connection (inch) | 1.0 |
| Safety Valve Connection (inch) | 1.0 |
| Safety Valve Feed Pressure (bar) | 1 |
| Drain connection (inch) | 1 |
| Compressed Air Connection (inch) | 1.5 |
| Compressed Air Pressure (bar) | (6-8) |
| Compressed Air Peak Use (ltr/pulse) | 125 |

## Dimensions

| | |
|---|---|
| Length - Main Body (mm) | 2460 |
| Length - Total (mm) | 4458 |
| Width - Main Body (mm) | 985 |
| Width - Total (mm) | 1758 |
| Height – Total (mm) | 2329 |
| Weight - Total (kg) | 5,000 kgs |

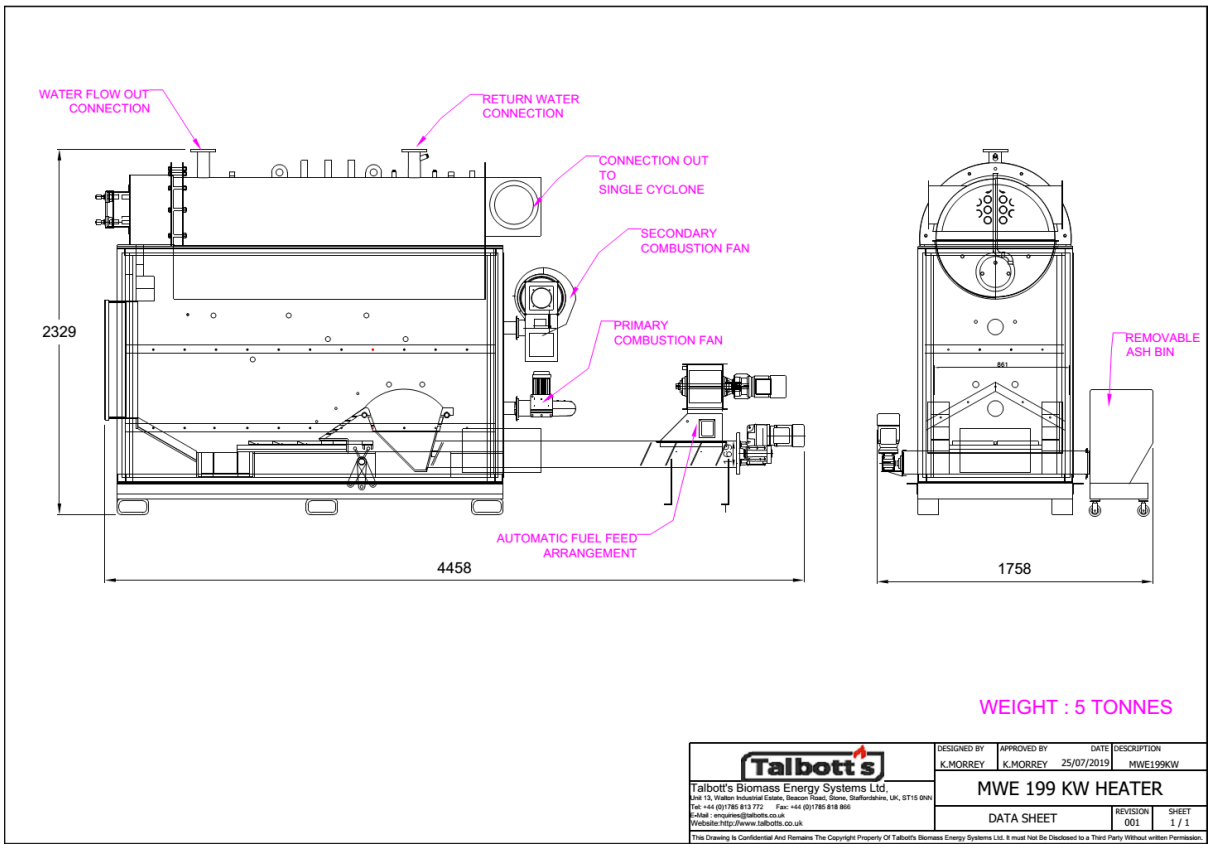
Heat Exchanger water volume (l) 750

Mains power supply – 26amp (3ph & neutral)

Flue design to be site specific

Max limits

| | |
|---|---|
| CO | 250mg/m³ |
| NOx | 400mg/m³ |
| Particulate | 60mg/m³ |



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Ref: G/P/BSC/MWES/MWE***

# Operation and Maintenance Manual

**Customer:**

**Model: MWE*****

**Serial Number: MWE0****

**Heat Medium: LTHW (max 95°C) Rated Capacity: ***kW**

**Fuel configuration: Wood Chips / Wood Dust / Wood Shavings**

**Issue Date:**

**Manufactured by:**

Talbott's Biomass Energy Systems Ltd
Unit 13, Walton Industrial Estate
Beacon Road,
Stone,
ST15 0NN

Telephone +44 (0) 1785 813772
Email enquiries@talbotts.co.uk

**Sales:**

Telephone +44 (0) 1785 813772
Fax +44 (0) 1785 818866
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**After-sales service:**

Telephone +44 (0) 1785 813772
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Email service@talbotts.co.uk

## Contents



**Section 1**

## 1.1) Introduction

This manual gives guidance for the safe and efficient operation of the Talbott MWE range of biomass boilers. This manual should be kept within close proximity to the unit for easy access to staff involved in the operation of the unit. **All staff must have read and understood this manual in its entirety before beginning any work on the unit, failure to do so can result in severe injury or death.**

This manual is designed to offer support in the safe and efficient operation of the Talbott MWE range units and should be used alongside the end users own health and safety guidance.

Any illustrations, screen shots or pictures contained within this manual are only intended to assist the operator and may differ from the parts used on your unit. Operators must adhere strictly to safety labels on the unit, as well as safety advice written within this manual.

## 1.2) Boiler description:

The Modern Wood Energy boiler is a fully automatic system with a range of advanced features allowing unparalleled levels of biomass fuel flexibility coupled with ease of operation, and high efficiency. Key features of the MWE boiler include:

- Modern PLC controls with large colour touch screen HMI, including full remote monitoring and maintenance via a LAN connection
- Built in back end, buffer tank and shunt pump control eliminate the need for external control panels
- Inverter controlled primary, secondary, and flue fans. Negative pressure controlled combustion chamber ensures safe operation in all conditions
- Automatic heat exchanger cleaning by compressed air maintains efficiency
- Three or two zone (is in depending on the model) moving grate with large burning area made from long life high chrome cast iron grate bars, with split three zone primary air control
- Water cooled combustion grate for burning of high ash fuels. Avoids clinker formation and extends life of the combustion grate by reducing temperatures. Allows high efficiency burning of MDF and chipboard residues
- Moving grate conveys ashes to the ash screw, which removes them to an external ash bin. Optional additional augers can elevate ash to an external skip.
- Twin electric automatic Ignition lights the fuel from underneath the grate, ensuring a good flame and a reliable boiler start without overfilling. 3 stage ignition control allows precise configuration to suit any fuel.
- Lambda control regulates fuelling to compensate for variation in fuel feed and maximise efficiency. Short term adjustments are made by altering the air supply rate, while longer term corrections are made to the fuel feeding rate. Unique lambda cleaning system using compressed air allows the use of dusty fuels and extends the life of the sensor
- Flue gas re-circulation allows the use of normal wood, and also the dry high calorific fuels such as MDF and chipboard residues. Keeps NOx emissions low on high

Nitrogen fuels such as MDF and chipboard. Restricts furnace temperatures to safe levels

- Fully brick lined combustion chamber ensure high temperature burn and ultra low emissions, even when burning MDF and chipboard residues.
- Primary and secondary air pre-heating
- Air cooled combustion chamber with low surface temperatures minimises heat loss

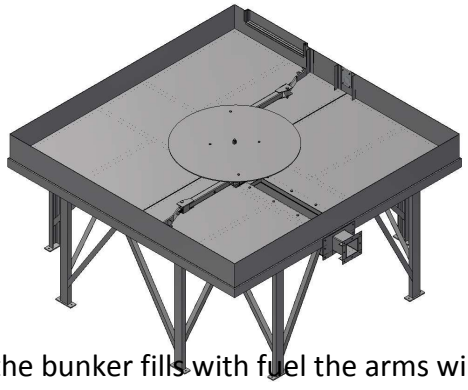
## 1.3) Fuel Bunker Description

***Description***

The bunker allows for a buffer between the boiler and the varying production of the factory. The boiler system is designed to operate only with adequate fuel in the bunker. If the boiler shows a 'fuel request time out' fault the bunker has run empty, and the operating regime of the boiler needs to be altered accordingly. The bunker will be designed to accept your method of fuel transport (e.g. dust extraction or conveyer belt system). It will be sized to the site requirements; however, it is important to note that the full theoretical capacity of the bunker can never be fully utilized as it should never be allowed to run empty or be overfilled. The agitating mechanism within the bunker facilitates reliable feeding to the boiler. However – it cannot empty the bunker completely as it operates in a circular motion, therefore the corners will always have fuel remaining when the feed to the boiler runs out. It is therefore recommended to keep the bunker at least 1/3$^{rd}$ full at all times. Please note that effective heating capacity of the bunker will depend on fuel configuration, density, etc.

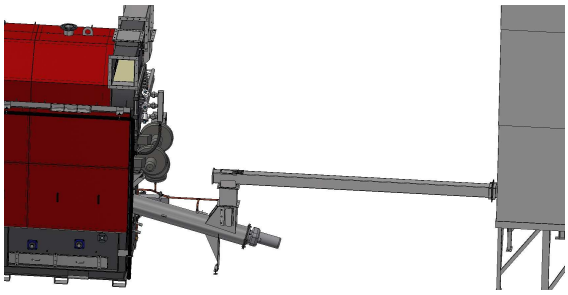
***Operation***

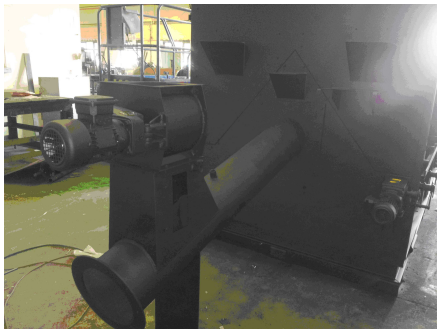
The fuel is transported into the bunker. To remove the fuel from the bunker the agitator drive gearbox is bolted to the far end of the bunker screw. The ratio gearbox's shaft sits within the bunker and turns when the bunker screw gear box runs. Attached to the shaft with the bunker are two spring loaded arms with a disc bolted on top.



As the bunker fills with fuel the arms will fold back under the plate to take material from the center of the bunker. As the material level drops the arms will gradually reach around the

sides of the bunker and drag any material resting on the sides. This material is dropped into the screw tube which is then fed through a rotary valve and into the heater screw. A light sensor controls the running of the bunker screw and ensures that the stoker is constantly filled with fuel, allowing an even stoking of the plant even if the fuel flow from the bunker varies. The boilers stoker screw then transports the fuel into the combustion chamber.





***Square Bunker***


***Details of silo overfill/interlock***

The silo is fitted with a rotary paddle switch that activates when the silo reaches 1 metre below its full level. This warns the operator to switch off the shredder or divert the dust extraction to prevent overfilling of the bunker. In some cases this is automatic. **IT IS CRUCIAL THAT THE BUNKER IS NOT OVERFILLED AS THIS CAN CAUSE A BLOCKAGE IN THE CYCLONE ABOVE THE BUNKER WHICH WILL THEN HAVE TO BE MANUALLY UNBLOCKED.**

***Maintenance***

Gearbox oil levels will be checked at yearly or 6monthly services. Gear box oil will be replaced every three years.

Bunker arms should be inspected every 6 months. The bunker needs to be run till empty to allow access. Ensure the springs are still under tension from the spring and retract when required.

Unless you are trained in confined spaces, you should not enter the bunker. Biomass fuel vessels can pose a hazard with regards to carbon monoxide poisoning. Therefore, unless you are fully trained to work on biomass bunkers then you should request assistance from the manufacturer. Opening the access hatches can also potentially pose a significant health risk. See section 5.

## 1.4) Responsibilities of the Operating Company

The operating company is responsible for complying with the Health and Safety requirements as prescribed by law.

In addition to the safety instructions contained in this manual, local regulations regarding safety, accident prevention and environmental protection must also be complied with.

**The operating company must:**

- Carry out a risk assessment to determine additional dangers that arise from the specific working conditions on the site of operation. Specific instructions based on your risk assessment must be accessible at any time for the operation of the unit
- Periodically check whether instructions compiled continue to comply with updated health and safety guidelines and alter accordingly
- Define the responsibilities for operation, maintenance and cleaning of the unit and appoint a competent person for each role
- Provide periodic staff training
- Provide operators with required personnel protective equipment as required.
- Ensure all staff with any interaction with the unit have read and understood this manual.
- Ensure the unit is technically sound at all times. The below must be adhered to;
    - maintenance intervals described in this manual are complied with
    - all necessary safety and protective devices are operational and checked before start-up.

All staff operating this unit must receive training by the manufacture or manufacture approved operatives. **Unauthorised personnel should be kept away from the unit.**

Talbott's recommends that the plant manager prepares a risk assessment for the safe use and maintenance of the heater.

**Personnel Protective Equipment**

During contact with the unit PPE must be worn in accordance with Health and Safety Regulations in order to minimise health risks.

- **Protective Clothing**
    - Protects users from entrapment in moving parts. Jewelry should not be worn.

- **Safety Shoes**
    - Protects user from heavy fallen or dropped objects and aids grip on wet surfaces.
- **Safety Gloves**
    - Protects hands from abrasions and hot surfaces.
- **Protective Goggles**
    - Protects eyes from flying debris and splashes of liquid.
- **Light Breathing Protection**
    - Protect from health damaging dust.

## 1.5) Safety Notices

**Warning**

Assure that you fully understand the instruction manual and have received sufficient training in the use of this machine and the particular safety precautions to be observed. Persons under the age of 18 years should not operate this machine except under supervision during a course of training.

**BEFORE OPERATING THIS MACHINE ENSURE THAT:**

- **All guards and fences are securely fitted and correctly set in accordance with the current regulation**
- **Any ancillary equipment including pipework, valves, pumps heat dissipation equipment etc. is in the correct state to allow adequate dissipation of the heat generated**
- **That suitable fresh air ventilation is available to the unit, according to BS6644 (summary below)**
- **Unit is clean, and has been maintained according to the regular schedule in section 3**
- **Loose clothing is either removed or fastened and jewellery removed**
- **That a suitable fuel is being used**
- **That the working area is well lit, clean and unobstructed**
- **That suitable PPE is worn**
- **That a suitable CO monitor is fitted and functional within the plant room.**

**WHEN SETTING, CLEANING AND MAINTAINING THIS MACHINE**

Ensure all moving parts of the machine are stationary and electronically isolated before setting, cleaning or making any adjustments.

Report immediately to a person in authority any machine malfunction or operator hazard. Do not attempt to repair the machine unless competent to do so.

Ensure all power sources are isolated before any maintenance work commences. There are multiple power sources for different components within the overall heating system.

**WHEN IN OPERATION**

Parts of the unit may be above normal temperatures, do not touch any parts other than instructed.
**Do not open the boiler door while in operation** or whilst there may still be unburnt fuel in the combustion chamber to avoid the danger of flashback.
**PLANT ROOM VENTILATION (per BS6644)**

Minimum boiler room vent sizes – note all info is given per single boiler of the size listed.

| **Vent (Free area)** | **MWE199** | **MWE300** | **MWE600** | **MWE999** |
|---|---|---|---|---|
| Low Level | 0.12 m² | 0.16 m² | 0.3 m² | 0.48 m² |
| *Size of opening** | 0.34 x 0.34 m | 0.40 x 0.40 m | 0.54 x 0.54m | 0.69 x 0.69 m |

| | | | | |
|---|---|---|---|---|
| *Size of Louver**[1] | 0.68 x 0.68 m | 0.80 x 0.80 m | 1.09 x 1.09 m | 1.38 x 1.38 m |

* *Based on square shaped opening without louver*

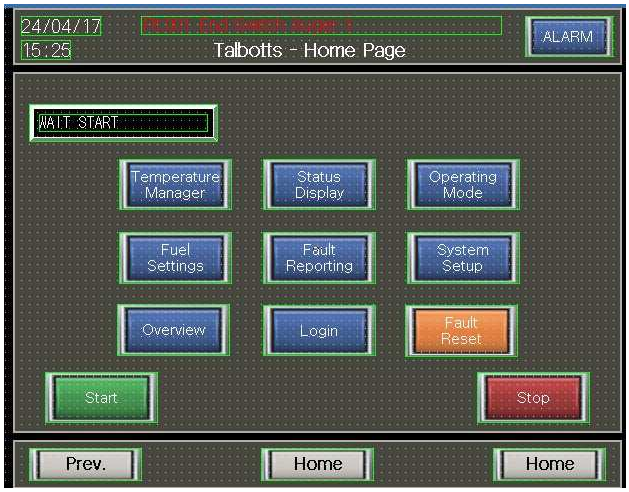
*[1] *Based on square opening, with typical louver installed (50% free area)*

## 2 – Boiler controls operation and description

### 2.1) Starting and Stopping the boiler:

Power up the boiler using the isolator on the front of the control panel (it is recommended to leave the control panel powered up at all times, unless the boiler will not be used for a long period). Allow the control panel to boot up and press the button to acknowledge the power failure. Press the reset button on the front of the panel to reset any existing faults. The home screen is then displayed (FIG. 1)

FIG. 1




**Login:**

**Commissioning code** this is a code unique to each boiler, once entered by the commissioning engineer will allow the boiler to be run up to the point it needs to be re-started, if the boiler stops for any reason then the code must be entered again before the boiler will restart.

**Client access code** this is a code unique to each boiler, the code will be issued on the commissioning/handover certificate, this is a client access code, the person entering the code must have received suitable training to use the boiler and acknowledge the boiler has been fully commissioned, the code is a one-off code that removes the commissioning code protocol and allows the boiler to operate in the normal way.

**To Start:**

Press the start button, a dialogue box will appear asking for confirmation (FIG. 2). Press start, and the boiler will start up, begin with 'pre-ventilation' phase. The boiler will then clean the grate from the last burn and assess if a fire remains in the burn pot. If necessary, the boiler will start using the electronic igniter, and the status 'ignition' will be displayed. If a fire remains from a previous burn, the boiler will go straight to 'scorch phase'

FIG. 2


**To Stop:**

Press the stop button, a dialogue box will appear asking for confirmation. (FIG. 2) Press stop, and the boiler will go in to 'burn out' phase. Burn out phase runs for a fixed time, after this time the boiler will be in 'wait start' mode and will not fire again until it is manually started again using the process described above. Always allow burn out phase to complete before restarting the boiler or powering down the control panel. This ensures safe removal of the material in the boiler and prevents overheating which may occur if the control panel is powered off suddenly.
The boiler has a built-in time clock which eliminates the need for manual starting and stopping of the boiler in most circumstances.

**2.2) Operating mode:**

The boiler can operate with or without a time clock function. The time clock is toggled on and off in the operating mode menu (FIG.3). If the clock is off, as in the example below, the boiler will run all the time, and will only turn off if there is no load on the heating system. If the clock is active, the boiler will run only during the set periods.

FIG. 3


FIG. 4


**Time Clock**

There are four separate channels 1-4 which can be used to start and stop the boiler automatically at the set times on chosen days of the week. (FIG. 4)

The **TIMER OUTPUT** lights 1-5 indicate if a time channel is active. Channels 1-4 control boiler running times, channel 5 is a special timer to control the times in which heat exchanger cleaning is allowed. Timer 5 should be enabled 24/7 to always allow automatic cleaning of the boiler tubes. This is done by setting **start time** to 00:00 and **end time** to 23:59 and selecting every day.

Time clock examples:
Channel one could be set to run the boiler between 6am – 2pm Monday to Friday.
Channel two could be set to run the boiler between 10am and 2pm on Saturday
Channel three could be set to run the boiler between 4pm and 10pm Monday to Friday

By pressing the **NEXT** and **PREVIOUS** buttons, the **TIME PROGRAM NUMBER** will change to match the **TIME CLOCK PROGRAM NUMBER** e.g.1, 2,3,4,5. Press **READ TIME BUTTON** to display the current time program settings. To disable a time program turn off all the days and press **MODIFY TIMER BUTTON** THEN **SAVE TIME BUTTON.** The stop time must always be set later than the start time, or the changes will not be accepted. When you press the buttons, you will see the **TIMER STATUS LED LIGHT** to show the action has been completed. Always press **READ TIME** afterwards to ensure the changes have been saved.

To set a time program select the **DAYS,** Set a **START** and **STOP** time press **MODIFY TIMER BUTTON** THEN **SAVE TIME BUTTON.**

When you press the buttons, you will see the **TIMER STATUS LED LIGHT** to show the action has been completed.

**Please note the time clock works on a pulse to start and a pulse to stop so any time set will only switch on or off the output as the actual time passes. Once the time channels are set up correctly, then time clock must be activated in the operating menu by pressing the CLOCK ON/OFF button. When activated the button goes green and shows CLOCK ON**

**Before activating the TIME CLOCK button in the operating mode menu, ensure that at least one of the TIMER OUTPUT** lights 1-4 is on. If not, the boiler will shut down when the **TIME CLOCK** button is activated.

If the boiler is running and you want to switch on the time clock, you can bring on a time channel by setting the **START** time 1 minute ahead of the current time (note the end time must always be set later than the start time). Select the current day at the top, and press **MODIFY TIMER BUTTON** THEN **SAVE TIME BUTTON.** Wait for the current time to reach the start time, and then the timer output light should light up. Once a **TIMER OUTPUT** light is activated, the boiler can be put into time clock mode. You can then set the timer to your actual requirements.

**Boiler operating phases:**

The current operating phase of the boiler is always displayed below the boiler name. The different phases are described below:

- Pre-ventilation – a safety check is carried out prior to firing - this ensures that the flue is unobstructed and the boiler can be safely ventilated
- Ignition – The boiler has detected that there is no fire and the electronic ignitor has been activated
- Scorch – A fire has been established but is still small, the boiler runs with special parameters designed to establish a good fire bed in the combustion chamber
- Modulation – The boiler is running normally and seeks to maintain the set water temperature by altering its output automatically to meet the existing load conditions of the heating system
- Burn Out – The boiler has reached temperature, been switched off manually, or has a terminal fault and is removing residual fuel and heat prior to switching off
- Wait start – The boiler has finished burn out phase and is waiting to re-start. Note – this will happen automatically when the temperature drops to the set point, provided the boiler has not been switched off manually or faulted out
- Faulted – Indicated by a red bar at the top of the screen containing a fault code. The fault must be resolved and the reset button on front of the control panel pushed before the boiler can be re-started.

**2.3) Test menu:**

The control panel features a test menu allowing individual motors and actuators to be started and stopped. This is useful for diagnosing the cause of faults, for example tripping of a Motor Circuit Breaker. The test menu allows certain augers to be run backwards to clear blockages but must be used with caution to prevent jamming of augers by running in reverse. It is recommended only to use the test menu when instructed to do so by a Talbott's engineer.

If the boiler faults out due to the silo running empty, it is recommended to use the test menu to re-charge the augers with fuel prior to igniting in automatic mode, failure to do so will likely result in an ignition failure due to lack of fuel reaching the burner. To use the test menu press ‘operating mode’ (FIG 5), followed by ‘manual mode’, and then manual mode again. Note – Manual mode must be highlighted to be activated (FIG 6). Once it is, press ‘manual test menu’ (FIG 6). A list of devices available for test is displayed over several pages (FIG 7) to refill the auger; you must first activate the rotary valve, and then the augers in the correct sequence as below (FIG 8):

1. Rotary valve
2. Primary auger
3. Bunker

If the area below the rotary valve is full, or the sensors cannot see each other due to dust build up, the augers will not run even in test mode to prevent accidental damage to the augers. The augers will stop automatically once the sensor indicates that the fuel demand is satisfied. Ensure that automatic mode is reactivated before leaving the test menu, as the boiler will not start up in manual mode (FIG 6).

FIG. 5


192.168.0.152
192.168.0.152
15/07/15
10:52
Operating Menu
ALARM
Clock Off
Automatic Mode
Manual Mode
HMI Utility
Time Clock
Boiler Type
Laddder
Prev.
Home
Sub Menu
Operating authority can be obtained.

FIG. 6


192.168.0.152
192.168.0.152
15/07/15
10:55
Automatic-Manual Mode
ALARM
Are You Sure You Want To Change From
AutomaticTo Manual Or Manual To Automatic
Automatic Mode On
Manual Mode Off
Manual Test Menu
Prev.
Home
Sub Menu
Operating authority can be obtained.

FIG. 7

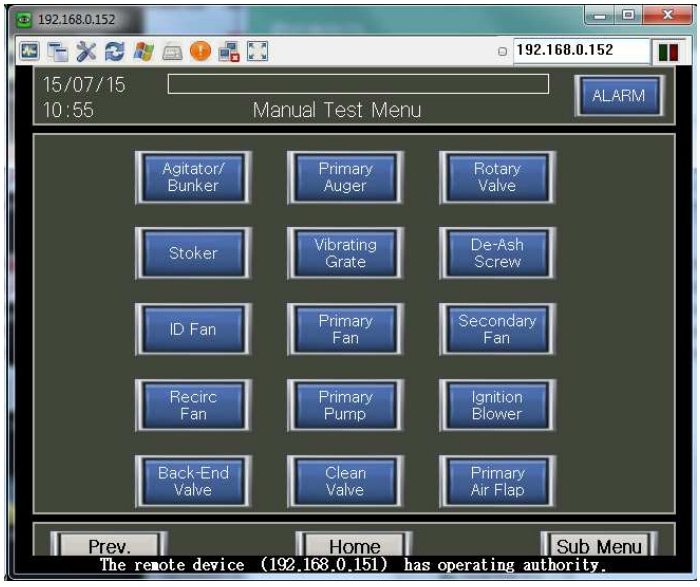

192.168.0.152
192.168.0.152
15/07/15
10:55
Manual Test Menu
ALARM
Agitator/ Bunker
Primary Auger
Rotary Valve
Stoker
Vibrating Grate
De-Ash Screw
ID Fan
Primary Fan
Secondary Fan
Recirc Fan
Primary Pump
Ignition Blower
Back-End Valve
Clean Valve
Primary Air Flap
Prev.
Home
Sub Menu
The remote device (192.168.0.151) has operating authority.

FIG. 8


**2.4) Altering flow temperatures:**

The control system features a temperature manager, designed to modulate the boiler output and start and stop the boiler automatically in response to the heating demand. The target temperature can be modified by pressing the 'temperature manager' button, and then 'boiler settings' (FIG 9)

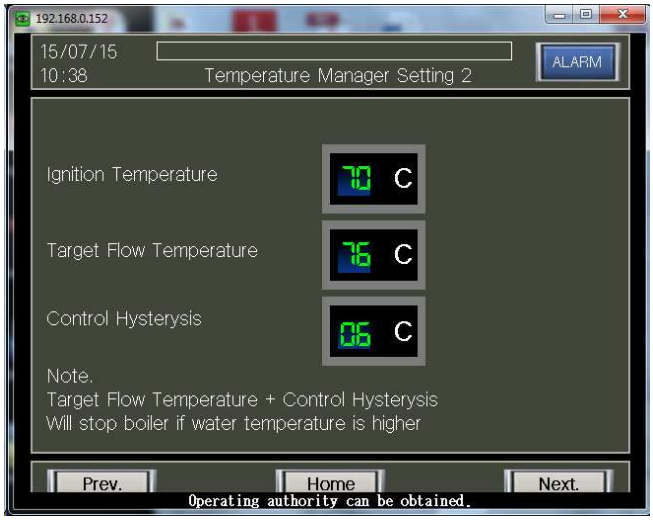
FIG.9


FIG. 10

**Temperature manager boiler settings 1 (FIG. 10)**

- Pump trigger is the temperature (not adjustable) above which the boiler primary shunt pump is activated (when the boiler is running).
- Stage 1 frost is the temperature below which the boiler shunt pump is activated for frost protection. Stage 1 frost is triggered by any of the boiler / buffer top / buffer bottom / return / outside air sensors. Warning fault 303 is given.
- Stage 2 frost is the temperature below which the boiler (unless stopped by the emergency stop input or by a critical fault) is fired for frost protection. Stage 2 frost is triggered by the boiler temperature sensor. Warning fault 304 is given.
- The boiler maximum is the maximum allowable temperature in the boiler prior to generation of an over temperature fault message. The boiler must shut down and burn out in good order without exceeding this temperature. The software restricts the value to maximum 95ºC.

FIG. 11




**Temperature manager boiler settings 2 (FIG. 11)**

- Ignition temperature is the temperature at which the boiler re-ignites following a burn out, provided a terminal fault has not been registered by the control panel. Ignition temperature is based on the buffer tank top sensor, if a buffer tank is installed and selected in 'buffer tank settings'. If the system is running without a buffer tank, the ignition temperature is based on the boiler temperature sensor reading. **THE BOILER WILL NOT START UNTILL THE RELEVENT TEMPERATURE IS BELOW THE SET POINT FOR SAFETY REASONS.** If the boiler will not start, you must remove heat such that the temperature falls below the set point.
- Target flow temperature should be set to suit the temperature required by the heating system. The boiler will, whilst active, seek to maintain the target temperature by modulating its output to match the load. Target temperature must be set in the range of 65 ºC to 85 ºC.
- Control hysteresis allows for the inherent variation of flow temperature required for successful operation of the boiler. Control hysteresis should always be maximized according to the temperature requirements of the heating system; the appropriate value can be calculated using the following formula:

**(95 ºC – 5 ºC) – target flow temperature = control hysteresis**

- The boiler will **shut down** at Target Temp + Control Hysteresis; the boiler will wait until the water temp has dropped below the ignition temp before restarting.

NB – The ignition temp is Re-ignition **water** temp (Not initial Ignition Fire Temp)

**Automatic power output modulation:**

After reaching the set temperature, the control system will modulate the boilers output between 100% and 30% **to the nearest 10%**. This allows the boiler to respond to the heating demand from the building without switching on and off, increasing efficiency. The boiler will load in fuel feed rates and fan speeds from a pre-set table. As the output decreases the fuel insertion rates and fan speeds will fall, resulting in a reduced output.

**Temperature manager boiler settings 3 and corrected settings pages are redundant**

FIG. 12


**Temperature manager Back end protection 1 (FIG. 12)**

The system controls return water temperature to the boiler to protect against corrosion caused by low return water temperatures, extending the life of the boiler.

- PID settings control how aggressively the valve moves in response to return water temperature changes
- Return temperature target is not user adjustable and is fixed at 60oC. The actual value is the current reading shown for information only.

FIG. 13


**Temperature manager Back end protection 2 (FIG. 13)**

- Back end protection fault timer – after the set time delay a warning fault will be raised if the return temperature has not reached the target (excludes times when the boiler flow temperature is also below the target, e.g. during start up).
- Back end protection valve open time – The time that the valve takes to travel from fully closed to fully open should be entered here, normally this is written on the valve actuator. Incorrect values will cause 'hunting' of the control.
- Back end protection pulse interval time – The time delay between pulses sent to the valve actuator. Lower values allow quicker response, but at the expense of smooth control. If the valve is hunting excessively, enter a higher value to smooth the control. Note – excessive times must not be entered, as the valve can be too slow to open and therefore cause the boiler to overheat following ignition.

**Temperature manager Buffer control 1 and 2 are not used unless a buffer is fitted.**

FIG. 14


**Temperature manager Boiler output (FIG. 14)**

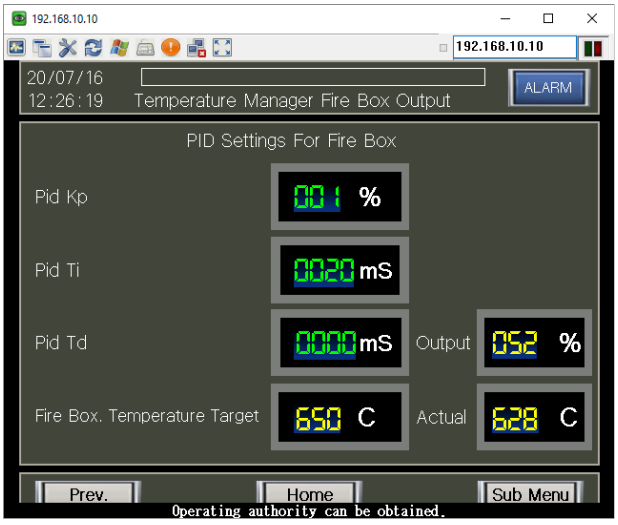
- The PID settings control how aggressively the output power is altered in response to the current boiler temperature. Low kp and high Ti values will result in slow control, which can cause overheating. High kp and low Ti values will result in very rapid fluctuation, which has a negative effect on combustion. The parameters should be set such that the boiler modulates smoothly, but rapidly enough not to overheat when the load is suddenly reduced in response to heating demand. Heating systems must always be set up to ensure that the heating load is not stopped suddenly, as this will likely result in overheating of the boiler and a lock out of the controls. If a heat dump is not available, temperature targets and controls bands (see FIG. 11) must be set accordingly to prevent overheating.

FIG. 15


**Temperature manager Boiler output (FIG. 15)**

- The PID settings control how aggressively the output power is altered in response to the current boiler temperature. Low kp and high Ti values will result in slow control, which can cause overheating. High kp and low Ti values will result in very rapid fluctuation, which has a negative effect on combustion. The parameters should be set such that the boiler modulates smoothly, but rapidly enough not to overheat when the load is suddenly reduced in response to heating demand. Heating systems must always be set up to ensure that the heating load is not stopped suddenly, as this will likely result in overheating of the boiler and a lock out of the controls. If a heat dump is not available, temperature targets and controls bands (see FIG. 11) must be set accordingly to prevent overheating.
- Flow temperature target is loaded automatically; output and actual flow temp are displayed for information only.

FIG. 16




**Temperature manager Fire box output**

Aa PID control overrides the normal control over boiler firing rate (see Fig 15). If the combustion temperature exceeds the setting, the boiler will modulate output to maintain fire temperature at the set value.

- The PID settings control how aggressively the output power is altered in response to the current fire box temperature. Low kp and high Ti values will result in slow

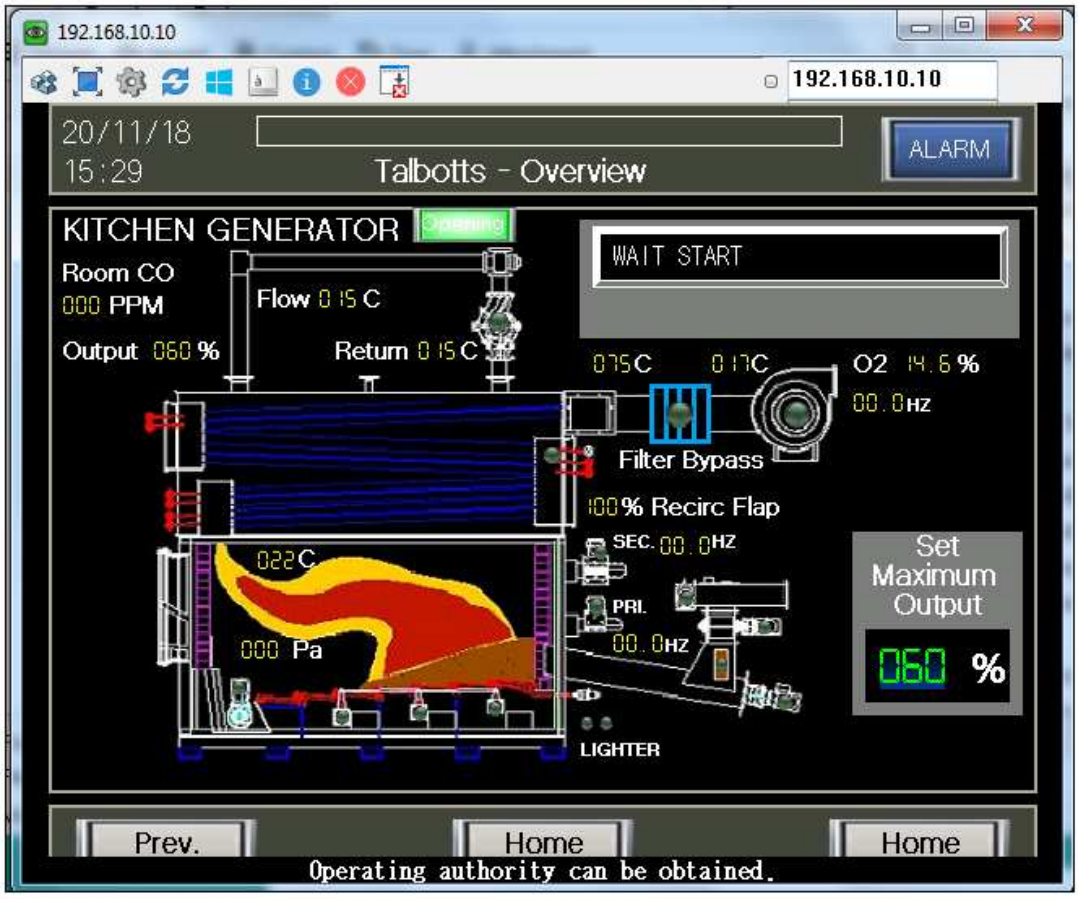
control, which can cause overheating. High kp and low Ti values will result in over-compensation to changes.

- Firebox target temp is loaded in from fuel settings page (see FIG. x)
- Current output and firebox temperature are displayed for information only.

**2.5) Monitoring boiler performance:**

The conditions existing in the boiler at any moment in time can be monitored via the Overview screen (FIG.17)

FIG. 17




Green dots indicate when each motor or sensor is activated. Running speed of fans is shown in Hz, all key boiler parameters including flow, return, flue and combustion temperature, oxygen and under pressure are displayed at the point of measurement. The current boiler output power is displayed in the top left of the screen, and the operating phase in the top right.

The correct operation of the boiler system can therefore be assessed with a quick glance at the screen. It is recommended that boilers are visually checked in this way at least daily by an operator who is trained and understands the normal running conditions of the plant. If necessary, this can be via the remote connection (facility provided within the panel but requires an internet connection)

The sensor readings page (FIG. 19) gives more detail on the targets and limits that are pre-defined by various settings entered by your commissioning engineer. Press ‘status display’ and then ‘sensor readings’ (FIG. 18) to see the feedback from the various sensors controlling the boiler. The screen is useful to monitor boiler performance and gives indications if there are any issues with the boiler that need attention.

The maximum boiler output target can be set from this screen.

FIG. 18


FIG. 19


**Status display sensor 1 (FIG.19)**

- Output – Displays the current power in the actual column. Special phases are displayed as IG – ignition / SC – scorch / BO – Burnout / CD – Cool down. The maximum output varies depending on the setting in the fuel selection window ‘additional parameters’.
- Fire temp – displays current fire temperature. Min. corresponds to ‘ignition temperature’ in the fuel selection window ‘additional parameters’. Max. Corresponds to ‘recalculation temperature’ in the fuel selection window ‘additional parameters’. Fire temp should not exceed 900°C to avoid damage from overheating
- Flue temp – displays current flue temperature. Max. Corresponds to ‘stop flue loss’ temperature in the fuel selection window ‘additional parameters’. If the boiler reaches the maximum, it indicates that the heat exchange is inhibited and the tubes require manual cleaning.

**Sensor 1** – displays Flue Exit Temp, controls Flue Gas Minimum, controls Stop Flue loss – Stage 1 and controls the Filter bypass valve

**Sensor 2** – Displays Cyclone discharge/fan inlet Temp, will put boiler in emergency shutdown if sensor 2 is higher than sensor 1 indicating a fire within the filter, controls Stop flue loss – Stage 2.

- Flow temp - displays the current water temperature in the boiler. The target corresponds to the 'target flow temperature' in the boiler adjustment window. The minimum is not adjustable and triggers the boiler primary pump output. The maximum corresponds to 'boiler maximum' in the boiler adjustment window. If the boiler exceeds the maximum, it indicates that heat is not being adequately removed from the boiler, indicating some issue with the hydraulic system / pumps or heat dissipater.
- $O_2$ – Displays the current oxygen reading. The target corresponds to the value in fuel selection for the current power output. The min corresponds to 'lambda stop' in the lambda control window. If O2 goes below lambda stop, fuel feeding is temporarily suspended. If the O2 target cannot be reached it indicates an issue with the combustion. Low values indicate overfilling, while high values indicate a lack of fuel. If values are consistently high or low the boiler should be switched of and the combustion chamber and oxygen sensor inspected and cleaned as necessary.
- Under pressure – displays the current under pressure in the combustion chamber. The target corresponds to the value in fuel selection window for the current operating phase. The minimum corresponds to 'under pressure minimum' in 'under pressure control'. Under pressure fault indicates a blockage or restriction in the flue gas path. Check and clean as necessary the boiler tubes, top of ceramic arches in combustion chamber, flue box on heat exchanger, flue ducting and riser, and cyclone. Check all lids and doors are securely fastened.
- $O_2$ air - shows the amount of correction being applied to the secondary air fan speed. The PLC loads the relevant value from the fuel table according to the current power output of the boiler. The exhaust gas $O_2$ is continually compared to the target and the difference fed into a PID control which calculates the necessary adjustment to bring the O2 back to the target. FIGX shows that the fan is currently at 71% of the set point – a 29% reduction in the set speed. The target column shows the value loaded from the fuel table, and the 'minimum' column shows the actual running speed of the fan. Please note – flue gas re-circulation also affects the actual running speed of the secondary fan – this correction is applied prior to the $O_2$ air correction and will result in a higher than expected running speed for the fan. In the example (FIGX) the correction is working, as the $O_2$ is currently very slightly below target, the fan speed will increase slightly until the target is met. If all is well, the O2 should be within +/- 2% of the target value

FIG. 20

**Status display sensor 2 (FIG.20)**

- $O_2$ fuel - shows the amount of correction being applied to the stoker screw running time. The PLC loads the relevant value from the fuel table according to the current power output of the boiler. The exhaust gas $O_2$ is continually compared to the target and the difference fed into a PID control which calculates the necessary adjustment to bring the O2 back to the target. FIGX shows that the stoker is currently at 138% of the set point – a 38% increase in the setting. The target column shows the value loaded from the fuel table, and the 'minimum' column shows the actual running time of the stoker screw. In the example (FIGX) the correction is working, as the $O_2$ is currently very slightly below target, the stoker screw setting will decrease slightly until the target is met. If all is well, the O2 should be within +/-2% of the target value.
- Outside air temperature – displays the current outside air temperature. Min corresponds to 'stage 1 frost' temperature in the 'boiler adjustment' window. Not normally used
- Flap – Actual shows the current position of the flue gas re-circulation flap. 100% is the default position and means 100% fresh air is being delivered to the secondary fan. As the combustion temperature exceeds the setting 'fire temp maximum' the flap will begin to close towards 0% (shown in the target column). This means the fresh air supply to the secondary fan is cut off, and the re-circulated gas supply opened up proportionally. This allows the insertion of 'air' with a lower oxygen content (previously combusted) therefore allowing an increase in the air volume delivered to the combustion chamber, without affecting the oxygen levels. This has a cooling effect on the flame and helps to limit combustion temperatures with very dry fuels.
- Return temp – Displays the current water temperature coming back to the return port of the boiler. Note – the hydraulic system includes a 3-port valve which is used to control return temperature. Hence if the system is cold, the 3-port valve will close to send the boiler flow directly back to the boiler return port. The valve is pulsed open / closed as required by the control panel. This allows the boiler to heat up quickly and prevents cold water from causing thermal stress to the heat exchanger, and condensation of flue gasses within which can lead to corrosion. It is important that the return temperature is maintained at or around the set point at all times. This is not possible if the flow temperature is less than 60. If started from cold, the boiler and its return should warm up before any hot water is delivered to the heating system to minimize the time the boiler operates with cold water in the heat exchanger.
- Buffer top temperature – displays current temperature at the top of the buffer vessel. Target corresponds to the 'target flow temperature' in the boiler adjustment window. Minimum corresponds to 'ignition temperature' in the boiler adjustment window. Not normally used
- Buffer bottom temperature – displays current temperature at the bottom of the buffer vessel. Not normally used
- Stoker temperature – displays the current temperature of the stoker tube. Max corresponds to the 'Burn back protection temperature' in the fuel selection window 'additional parameters'. If a burn back is detected, a fault will be logged and the

boiler will shut down, emptying the stoker screw of fuel to push the fire back to the combustion chamber.

**Trends**

The status menu also contains trend graphs for the following key boiler parameters:

- Flow temp (FIG.21)
- Return temp (FIG.22)
- Fire temp (FIG.23)
- Flue temp (FIG.24)
- Oxygen (FIG.25)
- Under Pressure (FIG.26)

Each graph can be scrolled through hour by hour or you can jump to a certain time using the jump to set time button. The examples given below all show what you would expect to see if the system is operating correctly.

FIG. 21

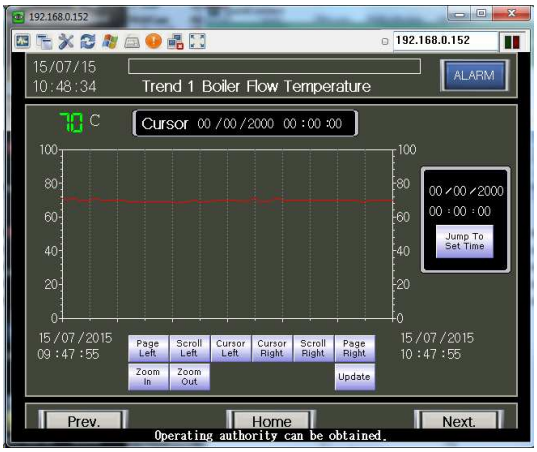



FIG. 22

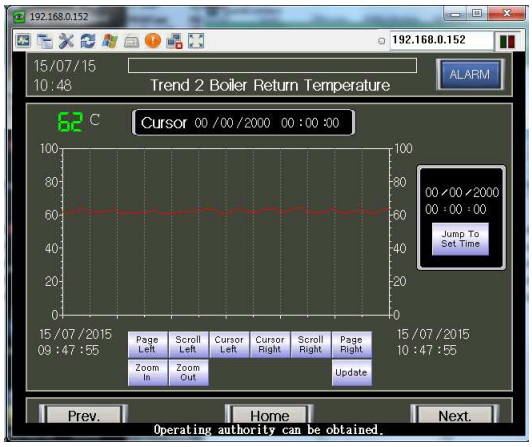



FIG. 23

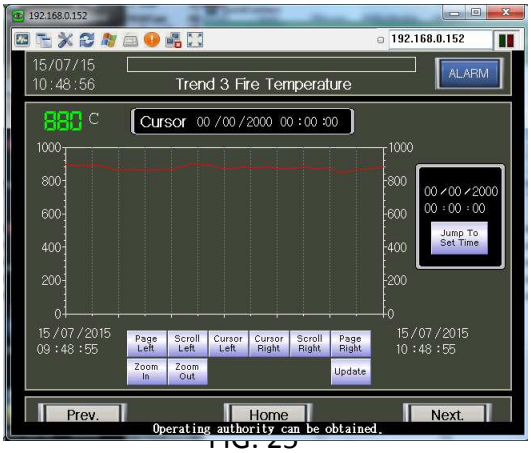
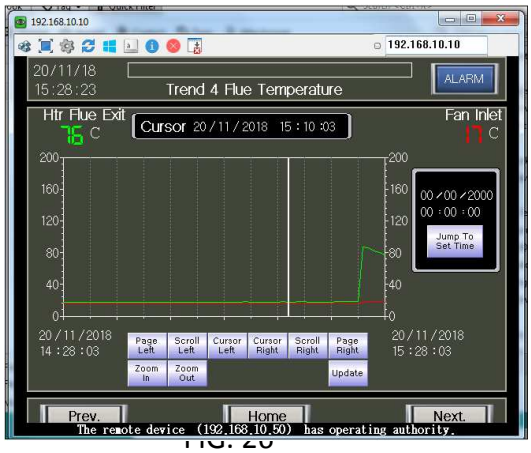
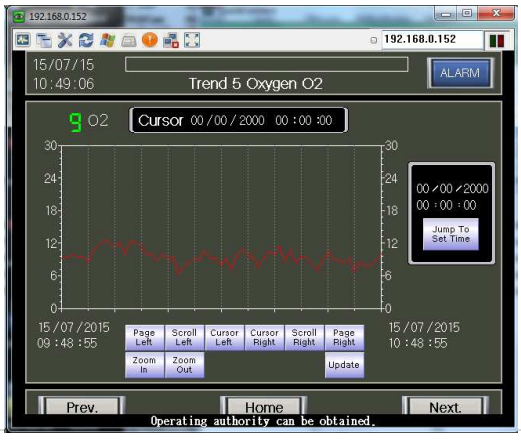
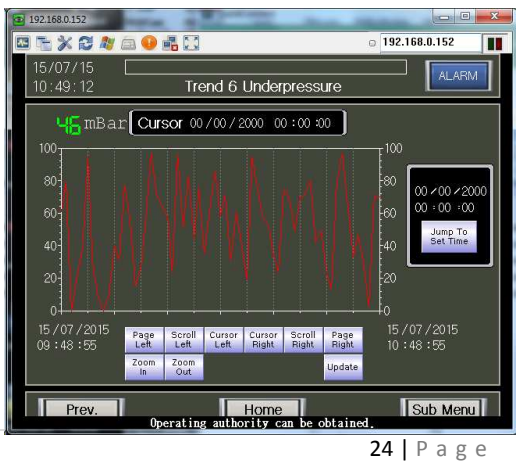



FIG. 24



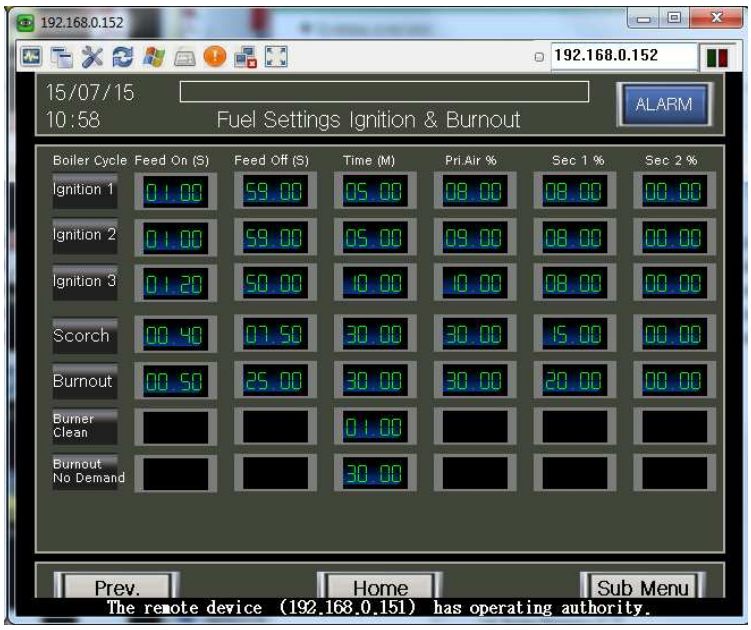



## 2.6) Fuel settings (ALTERATIONS BY AGREEMENT WITH TALBOTT'S ONLY)

The boiler combustion process in controlled by two fuel tables, 'normal operation' (FIG.28) and 'ignition and burn out' (FIG.27)

FIG. 27




**Fuel settings ignition and burnout (FIG.27)**

Feed on (s) - The running time of the stoker screw
Feed off (s) - The pause time of the stoker screw
Time (M) - The time in minutes for which the boiler runs in the current phase
Pri Air % - The running speed of the primary (under grate) air fan in Hz.
Sec 1% - The running speed of the secondary (over grate) air fan in Hz.
Sec 2% - Non functional
Burner clean (M) - Non functional
Burnout no demand (M) - Burn out time when there is no more heat demand

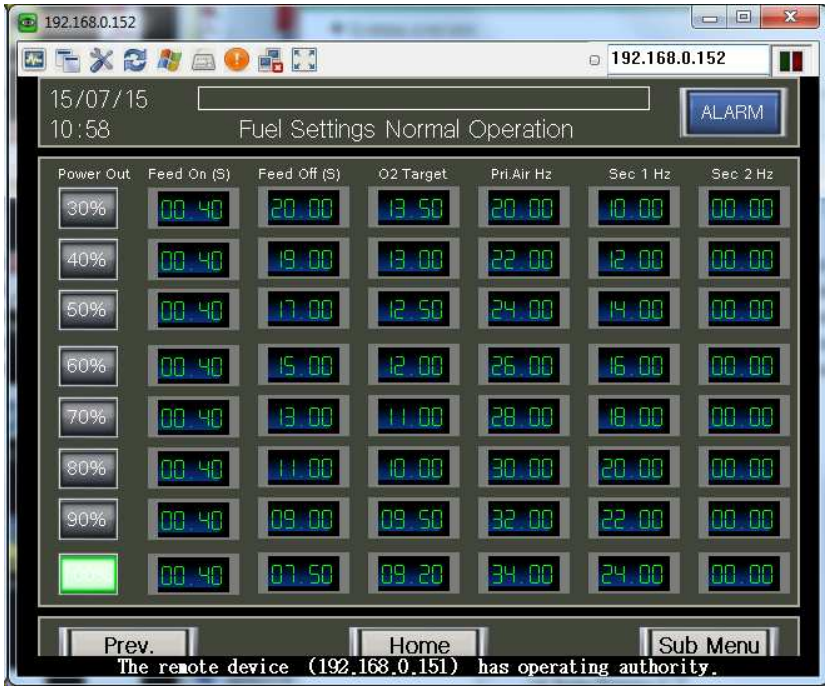
When the boiler starts, it will use settings from this screen to do so. If the boiler retains a fire from a previous burn, the ignition stages 1-3 will be skipped, and the boiler will begin at 'Scorch' phase. Scorch phase is always run in full for the set time before the boiler proceeds to normal operation (modulation phase) when it switches to the 'normal operation' fuel table.

If ignition is required, the boiler will run through phase's ignition 1 to 3, remaining on each for the set time. If the required ignition parameters are reached at any point, the boiler will jump immediately to scorch phase. If there is no ignition, the boiler will begin again and go through phases 1-3 a second time. If no ignition at this point an 'ignition fault' will be set and the boiler will shut down and lock out with a fault. Automatic ignition is only possible with dry (<30%MC) fuels and is not possible with 100% dust fuels. If using such fuel, the boiler should be manually lit and operated in 'pause' mode (see operating mode section).

The burnout line is used when the boiler shuts down, either by the user pressing stop, or on occurrence of any terminal faults (some faults skip burn-out for safety reasons). Once initiated, burnout always continues for the set time. Burnout will continue on if necessary

until the set cool down combustion temperature is reached (see fuel settings – additional parameters). If the boiler is shut down due to high water temperature (no heat demand) burnout will run for the time set in 'burn out no demand'.

FIG. 28




**Fuel settings normal operation (FIG.28)**

| | | |
|---|---|---|
| Feed on (s) | - | The running time of the stoker screw |
| Feed off (s) | - | The pause time of the stoker screw |
| Time (M) | - | The time in minutes for which the boiler runs in the current phase |
| O2 target | - | The oxygen level in the flue gas that the boiler must try to achieve |
| Pri Air % | - | The running speed of the primary (under grate) air fan in Hz. |
| Sec 1% | - | The running speed of the secondary (over grate) air fan in Hz. |
| Sec 2% | - | Non-functional |

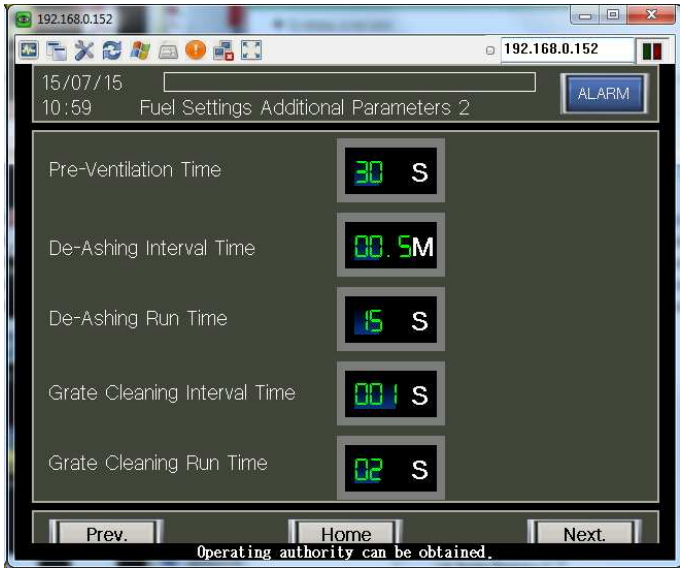
Depending on the current power output of the boiler, the relevant row which is being loaded into the PLC will be highlighted in green (in the example the boiler is running at 100%)

FIG. 29


**Additional Fuel Parameters 1 (FIG.29)**

- Pre-ignition filling time – The time for which the stoker screw runs to pre-fill itself and to push fuel into the correct positon in the combustion chamber for ignition. Occurs once every time the boiler is started. Stoker pre-fill will only happen providing a burn out phase has been completed. Overfilling can occur if the fuel is too wet or too dusty to ignite. It may be necessary to ignite manually in this case. If the ignitor tubes are buried under too much fuel auto ignition will not function.
- Ignition failure will enter a special burn out phase, only running pumps and I/D fan, no combustion fans, stoker movement or walking floor.
- End of ignition temperature – The combustion temperature at which the program ends ignition and moves to scorch phase. If the combustion temp is already over this value when the boiler is started, **the temperature must increase by 10°C in two-minute period to advance to scorch phase.** This is to prevent warmth remaining in the brickwork from defeating the auto ignition program.
- Cool down temperature – the combustion temperature which must be reached before shutdown of the machine. Burnout phase will continue until this target has been reached. For service / maintenance visits it is necessary to set this to a low value e.g. 20°C before stopping the boiler, to ensure the boiler is cool enough for entry the following day
- Cool down fan speed – No function
- Stop cool down – No function

FIG. 30

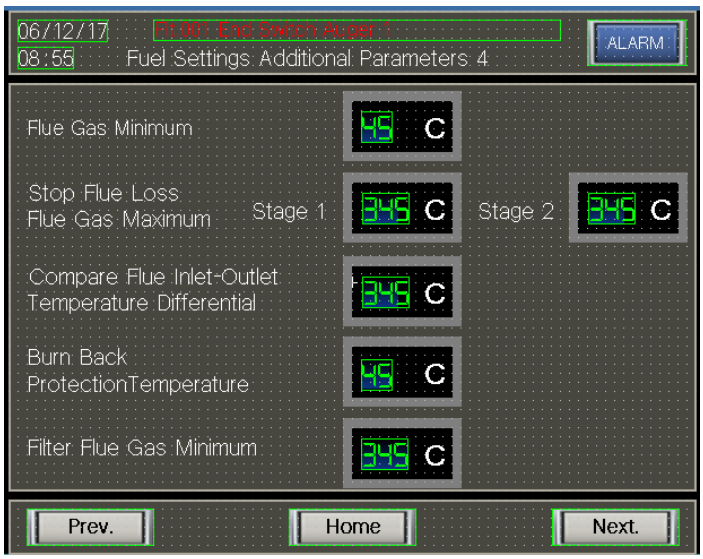



**Additional Fuel Parameters 2 (FIG. 30)**

- Pre-ventilation time – the time that is allowed for under pressure target to be obtained with just the flue fan running when the boiler is first started. Failure to reach the target will result in a fault and immediate shutdown. This is designed to detect if the chimney is blocked or the door has been left open etc.
- De-ashing interval time – the **running time in minutes of the stoker screw** before the ash screw is triggered to run. Because it is li 001 S Ignition Mode time not real time, the ash screw will always run in proportion to the a nserted regardless of what power the boiler runs at.
- De-ashing run time – ash screw running time in seconds
- Grate cleaning interval time - the running time in seconds of the stoker screw before the moving floor is triggered to run, this is independent in ignition.
- Grate cleaning run time – The running time in seconds of the moving floor

**Additional Fuel Parameters 3 -** None of the parameters are used, this screen if present is redundant

FIG. 31



**Additional Fuel Parameters 4 (FIG.31)**

- Flue gas minimum – flue temp lower than this value will trigger a warning fault, this can occur during start up when it is not a concern. It should not occur with the boiler running, as low flue temperature can cause condensation and corrosion in the heat exchanger tubes
- Stop flue loss – Stage 1 will cause the boiler to modulate to minimum power to avoid exceeding stage 2. Stage 2 will cause the boiler to fault out and shut down; this is to protect the fan from excessive temperatures. If this occurs the heat exchanger needs to be cleaned manually to lower the flue temperature.
- If the fan inlet probe shows a higher reading than the flue outlet probe on the heater by 50C the boiler will raise an alarm audible and visible with a message 'Filter Fire' the filter will go into bypass and put the boiler into emergency shutdown as follows:

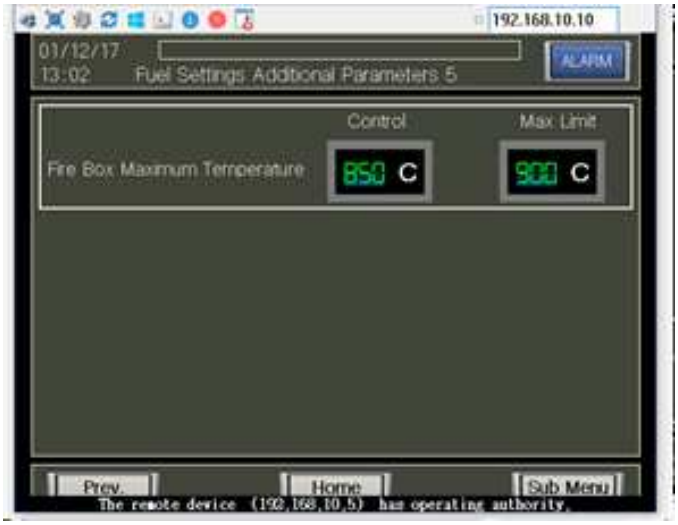
**Ignition, Burnout & Modulation**

1. Fault scenario

    1. Audible and visual alarms
    2. Bypass filter
    3. Keep ONLY I/D fan running to maintain under pressure for a minimum 30 minute period.
    4. Keep pumps running

- Filter Flue Gas Minimum – this will cause the filter to Bypass at value -2°C and Filter at value +10°C. **If the gasses are going through the filter and the I/D fan cannot make under pressure the control system will initiate a 30min bypass for the filter to clean off-line.**

FIG. 32




**Additional Fuel Parameters 5 (fig 32)**

- Fire box maximum temperature - Control parameter initiates a PID control which overrides the normal control over boiler firing rate (normally determined by water temperature). If the combustion temperature exceeds the setting, the boiler will modulate output to maintain fire temperature at the set value.
  - Max Limit parameter forces the boiler directly to minimum output when the combustion temperature exceeds the set value.

- Bunker vibrator start delay – Time delay before vibration of the bunker commences (this is a one off delay, which begins when the vibrator start delay button is pressed on overview page)
- Bunker vibrator on time – The vibrator will run for the set time after the vibrator off time has elapsed
- Bunker vibrator off time – After the vibration on time has elapsed; the controller will wait the set time before starting vibration again.

FIG. 33


**Fuel settings – lambda Control PID Air (FIG.33)**

- The settings are used to tune the responsiveness of the automatic correction for secondary air correction

FIG. 34


**Fuel settings – lambda Control 2 (FIG.34)**

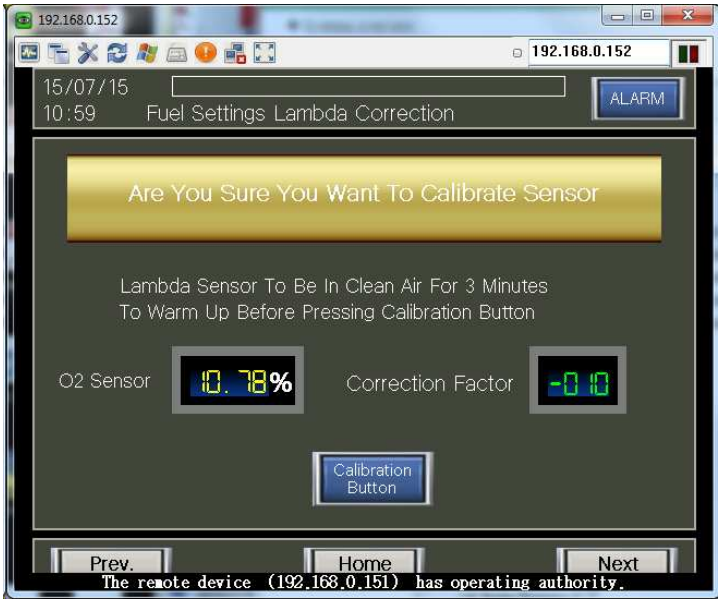
- Max fan speed correction factor – Sets the maximum automatic correction that can be applied to the secondary fan speed (+/- 30%)
- Max feed on correction factor – sets the maximum automatic correction that can be applied to the stoker screw running time (+/- 40%)
- Air correction time delay – time delay before fan speed correction is allowed

FIG. 35


**Fuel settings – lambda Control 3 (FIG.35)**

- Fuel correction time delay – time delay before fuel correction is allowed
- Lambda time out – Maximum time to achieve O2 target (not used)
- Oxygen OK fire lit – O2 must be lower than this threshold before the boiler can leave ignition and enter 'scorch phase' (indicator of the presence of absence of flame in the boiler).

FIG. 36




**Fuel settings – lambda Correction (FIG.36)**

- Allows calibration of a new sensor. Only calibrate with the sensor hot and in fresh air (no fire in boiler). **A small correction in the region of -20 to +20 is acceptable. If outside this range, replace the O2 sensor**. Control panel must be powered up for minimum 3 minutes to let the sensor warm up (via in built heater) before calibrating. Never calibrate with fire in the boiler! If accidently calibrated, the value can be entered manually by pressing the correction factor box and keying in the value.

FIG. 37


**Fuel settings – lambda Control PID Fuel (FIG 37)**

- The settings are used to tune the responsiveness of the automatic correction for secondary air correction

FIG. 38


**Fuel settings – Re-circulation control 1 (FIG.38)**

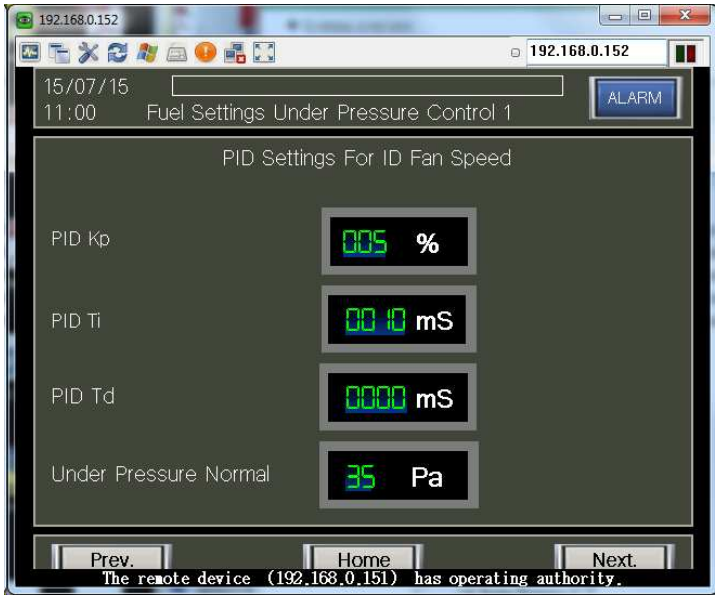
- The settings are used to tune the responsiveness of the automatic correction for secondary air correction
- Max flap position – used to restrict the percentage of flue gas that can be recirculated

FIG. 39


**Fuel settings – Re-circulation control 2 (FIG.39)**

- Recirculation start – combustion temp at which recirculation control starts
- Recirculation target temp – the target combustion temp to try to achieve
- Re-circulation timeout – time period allowed for the actuator to move to the set point before a fault is triggered
- Sec-fan speed increase factor – The amount by which the secondary air fan is sped up when the flap is fully actuated. The fan speed increases in a linear fashion as the flap opens. This increase the air volume delivered to the combustion chamber, providing a cooling effect to the flame

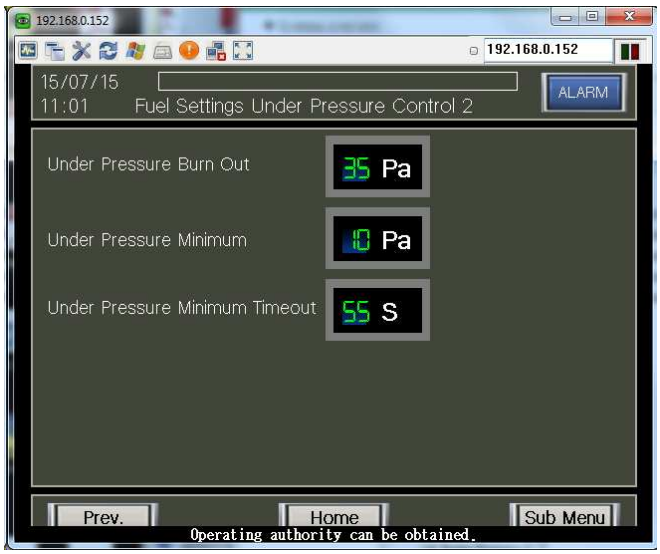
FIG. 40




**Fuel settings – Under Pressure control 1 (FIG.40)**

- The settings are used to tune the responsiveness of the flue fan speed control (according to negative pressure in the combustion chamber)
- Under Pressure normal – The target vacuum in the combustion chamber. The flue fan is controlled in speed to keep the set point.

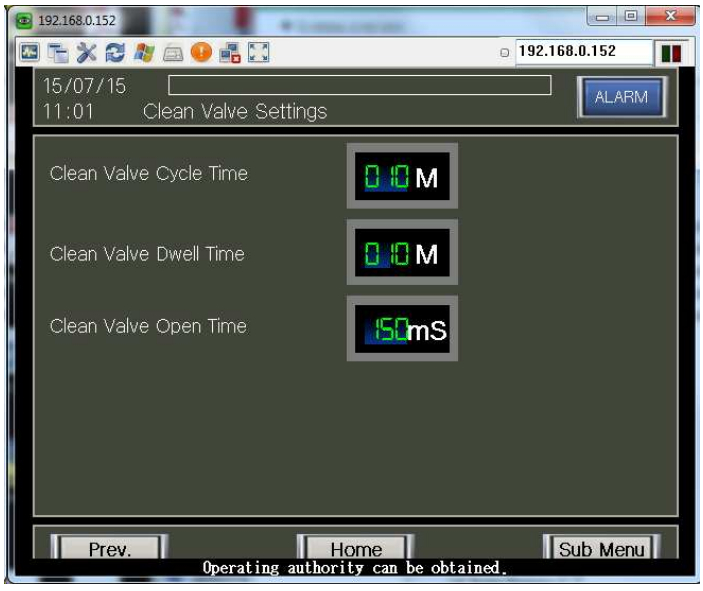
FIG. 41




**Fuel settings – Under Pressure control 1 (FIG.41)**

- Under Pressure Burn Out – The target vacuum in the combustion chamber during burn out phase
- Under Pressure Minimum – The threshold for to trigger an Under Pressure alarm
- Under Pressure Minimum timeout – Time for which the minimum threshold must be exceeded before a fault occurs

FIG. 42




**Fuel settings – Clean Valve Settings (FIG.42)**

The settings control the automatic cleaning of the heat exchanger, note the timer channel 5 must be activated for the cleaning to function. If noise sensitive, the valves can be disabled at certain times using time channel 5.

- Clean valve cycle time – pause time between cleaning cycles
- Interval time between each valve output activating in a cycle
- Opening time of the solenoid valve

FIG. 43


**Fuel settings – Fuel Settings Pause Mode (FIG.43). NOTE – not valid for all systems**

Only valid if pause mode is switched on in system setup / system configuration menu. This is only necessary if the fuel is too wet or dusty for reliable automatic ignition. If switched on, the boiler will enter pause mode if the time clock switches of the boiler, of if the water temperature exceeds the target and the boiler is forced off on temperature (no demand). The boiler will 'burn out' until the O2 reaches the set O2 target. The boiler will then stop completely and the interval timer (pause time) will start. When the time has elapsed a small portion of fuel will be feed, and the fans will run for the set time. The interval timer begins again. The cycle continues until demand returns, or the time clock restarts the boiler.

- Pause time (m) – the time interval between pause cycles. The counter begins again when a cycle is initiated. This continues until the boiler exits pause mode
- Feed on (s) – the stoker running time in seconds after the interval time elapses
- O2 target – the oxygen level to which burn out is carried out prior to entering pause mode and starting the interval timer
- Fan time (s) – the running time of the primary and secondary fans after the pause time interval
- Pri. Air % - The speed setting for the primary air fan
- Sec. Air% - The speed setting for the secondary air fan
- O2 vent – if the oxygen drops below the set point in an interval time, the flue fan will switch on to ventilate the boiler for safety reasons until the O2 reaches the O2 target.
- Pump trigger – the temperature at which the boiler circulating pump is activated when in pause mode

**2.7) Alarm Diagnosis and resolution:**

The boiler has two categories of fault.

- Terminal faults stop the boiler and are denoted by a description beginning F: They result in immediate shutdown of the boiler, which will go to 'burn out' mode and continue for the set time before stopping. Some specific faults will shut the boiler down immediately without burn out mode occurring, for safety reasons.
- Warning faults do not stop the boiler but may cause operational problems if ignored in the long term, they should be investigated and resolved in a timely manner

The relevant fault code will always be displayed in the top line of the display, in any screen. Current faults are displayed in red text. To see more information about a fault, press the alarm button. A list of faults is shown in order of occurrence, with the most recent at the top (FIG 44). The date and time of the fault can be displayed by pressing the watch symbol. Pressing the 'I' button gives fault resolution information (see section x fault list and descriptions).

FIG. 44


Please note – in the event of a power failure or the control panel being powered down, several terminal faults will be registered due to the emergency stop relay dropping out.

ONCE THE FAULT IS RESOLVED THE RESET BUTTON ON THE FRONT OF THE CONTROL PANAL OR ON THE MAIN MENU BOTTOM RIGHT MUST BE PRESSED BEFORE THE BOILER CAN BE RESTARTED.

**Important Notes**

An **I/D fan -** MCB/INV Fault should send the boiler into an emergency shutdown, this fault will put the boiler into an emergency shutdown scenario.

An **under-pressure** fault will carry out the following actions

**Pre-vent –**

1. if the under pressure hasn't been met for the set period then go into emergency shut down.

**Ignition & Burnout**

2. if the under pressure hasn't been met for the set period go into a **new** emergency shut down Fault scenario
1. Keep I/D fan running to maintain under pressure for a minimum 30 minute period.
2. Keep pumps running.

**Modulation –**

3. if the under pressure hasn't been met, following **scale back procedures**, go into a **new** emergency shut down Fault scenario
3. Keep I/D fan running to maintain under pressure for a minimum 30 minute period.
4. Keep pumps running

An **over-pressure** fault will carry out the following actions

**Pre-vent –**

4. if the over pressure switch has been triggered for 30 second duration then go into emergency shut down.

**Ignition, Burnout & Modulation**

5. if the over pressure switch has been triggered for 30 second duration then go into a **new** emergency shut down Fault scenario
5. Keep I/D fan running to maintain under pressure for a minimum 30 minute period.
6. Keep pumps running.

**Under & Over-pressure** alarms will bring on the flashing lights and audible alarms, if the over pressure switch is triggered this will override the under pressure response and show on screen to "**Evacuate the boiler house immediately leaving any doors open as there is a likelihood of carbon monoxide present within the plant room**", The carbon monoxide detector to the door of the panel will raise the alarm if detected using the pressure switch fault scenario but switching off the sirens and alarms when carbon monoxide is at safe levels…?

**NB it is important to fit at least one additional carbon monoxide detector within the plant room for the safety of the operator, please ensure this is carried out by a competent person.**

**Burn back fault scenario (all cases)**

7. If burn back is detected start burn back fault process as follows: -
    - Stop bunker screw.
    - Stop rotary valve.
    - Run stoker screw to empty fuel into combustion chamber.
    - Start boiler shut down.

**NB if the boiler has already shutdown and a burn back has been detected the following will happen: -**

- Run I/D fan for 60mins
- Run stoker screw to empty fuel into combustion chamber.

<u>If the **main door is open** at the time of **burn back detection** the control panel will: -</u>

- Instigate an audible alarm c/w flashing light and a message to shut the main door.
- Run I/D fan for 60mins
- Run stoker screw to empty fuel into combustion chamber.

## 2.8) full fault list with descriptions

- Each terminal fault (F) must be resolved before restarting the boiler.
- Warnings must be investigated and resolved in a timely manner, but will not prevent the boiler from firing. Ignoring warning faults can cause serious damage to the boiler, if the fault cannot be resolved contact the service department.
- Resolve the faults shown in the list in order until the list of current faults is empty.

## *BEFORE REMOVING ANY COVERS, ISOLATE THE BOILER*

| Fault Code on Display | Possible causes | Possible solutions |
|---|---|---|
| F: Fuel request timeout | • Bunker has run empty, or very low<br>• Fuel has bridged over the extract auger | • Refill – ensure the bunker is refiled early to avoid this fault. The extraction system cannot extract all fuel due to the nature of its construction<br>• Use a suitable size of wood chips to allow reliable feeding |
| F: ENDSWITSCH AUGER1<br>**Fault 001**<br>*Terminal fault, the boiler will not fire* | End switch Auger 1<br>• Blockage in area below auger inspection hatch | • Open auger inspection hatch, remove blockage, replace inspection hatch |
| F: ENDSWITSCH AUGER2<br>**Fault 002**<br>*Terminal fault, the boiler will not fire* | End switch auger 2<br>• Blockage in area below auger inspection hatch | • Open auger inspection hatch, remove blockage, replace inspection hatch |
| F:MCB AGITATOR<br>**Fault 003**<br>*Terminal fault, the boiler will not fire* | Motor protection switch agitator<br>• Agitator has a blockage<br>• MCB incorrectly set<br>• Fuel out of specification<br>• Motor defect<br>• Screw broken | Reset motor protection switch<br>• Remove blockage<br>• Set to match motor<br>• Use fuel that meets the required specification<br>• Replace Motor<br>• Replace screw |
| F:MCB AUGER1<br>**Fault 004**<br>*Terminal fault, the boiler will not fire* | Motor protection switch Auger 1<br>• Auger 1 has a blockage<br>• MCB incorrectly set<br>• Fuel out of specification<br>• Motor defect<br>• Screw broken | Reset motor protection switch<br>• Remove blockage<br>• Set to match motor<br>• Use fuel that meets the required specification<br>• Replace Motor<br>• Replace screw |
| F: MCB AUGER 2<br>**Fault 005**<br>*Terminal fault, the boiler will not fire* | Motor protection switch convey screw 2<br>• Auger 2 has a blockage<br>• MCB incorrectly set<br>• Fuel out of specification<br>• Motor defect<br>• Screw broken | Reset motor protection switch<br>• Remove blockage<br>• Set to match motor<br>• Use fuel that meets the required specification<br>• Replace Motor<br>• Replace screw |
| F: MCB ROTARY VALVE<br>**Fault 006**<br>*Terminal fault, the boiler will not fire* | Motor protection switch rotary valve<br>• Rotary valve has a blockage<br>• MCB incorrectly set<br>• Fuel out of specification | Reset motor protection switch<br>• Remove blockage<br>• Set to match motor<br>• Use fuel that meets the required |

| | | |
|---|---|---|
| | • Motor defect | specification<br>• Replace Motor |
| F: MCB STOKER<br>**Fault 007**<br>*Terminal fault, the boiler will not fire* | Motor protection switch stoker screw<br>• Stoker screw has a blockage<br>• MCB incorrectly set<br>• Fuel out of specification<br>• Motor defect<br>• Screw broken | Reset Motor protection switch<br>• Remove blockage<br>• Set to match motor<br>• Use fuel that meets the required specification<br>• Replace Motor<br>• Replace screw |
| F: MCB ASH SCREW 1<br>**Fault 008**<br>*Warning fault, the boiler will continue* | Motor protection switch ash screw 1<br>• MCB incorrectly set<br>• Screw is blocked because fuel contains foreign objects, or is causing excessive clinker formation<br>• Motor defect<br>• Screw broken | Reset motor protection switch<br>• Set to match motor<br>• Use fuel free of foreign objects, use a fuel that does not cause excessive clinker formation<br>• Replace motor<br>• Replace screw<br>• Resolve swiftly or stop boiler! |
| F: MCB ASH SCREW 2<br>**Fault 009**<br>*Terminal fault, the boiler will not fire* | Motor protection switch ash screw 2<br>• MCB incorrectly set<br>• Screw is blocked because fuel contains foreign objects, or is causing excessive clinker formation<br>• Motor defect<br>• Screw broken | Reset motor protection switch<br>• Set to match motor<br>• Use fuel free of foreign objects, use a fuel that does not cause excessive clinker formation<br>• Replace motor<br>• Replace screw |
| W: MCB FLYASH<br>**Fault 010**<br>*Warning fault, the boiler will not fire* | Motor protection switch fly ash<br>• MCB incorrectly set<br>• Motor defect<br>• Screw broken | Reset motor protection switch<br>• Set to match motor<br>• Replace motor<br>• Replace screw |
| F:MCB WALKING FLOOR 1<br>**Fault 011**<br>*Terminal fault, the boiler will not fire* | Motor protection switch walking floor 1<br>• MCB incorrectly set<br>• Motor defect<br>• Excessive clinker prevents the grate from moving | Reset motor protection switch<br>• Set to match motor<br>• Replace motor<br>• Switch of the boiler and clean the combustion chamber |
| F:MCB WALKING FLOOR 2<br>**Fault 012**<br>*Terminal fault, the boiler will not fire* | Motor protection walking floor 2<br>• MCB incorrectly set<br>• Motor defect<br>• Excessive clinker prevents the grate from moving | Reset motor protection switch<br>• Set to match motor<br>• Replace motor<br>• Switch of the boiler and clean the combustion chamber |
| F:MCB SHUNT PUMP<br>**Fault 013**<br>*Terminal fault, the boiler will not fire* | Motor protection switch primary pump<br>• MCB incorrectly set<br>• Motor defect<br>• The pump has a dead end | Reset motor protection switch<br>• Set to match motor<br>• Replace motor<br>• Check valves, strainers/bleed air |
| F: FLOAT SWITCH<br>**Fault 014**<br>*Terminal fault, the boiler will not fire* | Low level in fire safety water tanks<br>• Water level not sufficient to float switches | • Top up tank<br>• Replace cable |

| | | |
|---|---|---|
| | • Cable defect<br>• The water has been used to douse a burn back | • Investigate the cause of the burn back (see 010 / 011) |
| W: STOKER TEMP 1<br>**Fault 015**<br>*Warning fault, the boiler will continue* | The safe stoker temperature was exceeded whilst the boiler was firing<br>• Boiler has an air leak<br>• Fuel store has run empty<br>• Rotary valve has an air leak | Investigate the cause of the fault<br>• Check all removable panels and seals for air tightness<br>• Refill storage room<br>• Check condition of rubber flaps and replace as necessary |
| F: STOKER TEMP 2<br>**Fault 016**<br>*Terminal fault, the boiler will not fire* | The safe stoker temperature was exceeded whilst the boiler was inactive<br>• Boiler has an air leak<br>• Fuel store has run empty<br>• Rotary valve has an air leak | Switch the boiler off, contact service department<br>• Check all removable panels and seals for air tightness<br>• Refill storage room<br>• Check condition of rubber flaps and replace as necessary |
| F: PRIMARY FAN<br>**Fault 017**<br>*Terminal fault, the boiler will not fire* | Inverter for primary air fan reports a fault<br>• Fan is isolated<br>• Inverter has a fault | • Check the isolator is in the on position<br>• Obtain the fault code from the inverter and refer to the inverter manual |
| F: SECONDARY FAN 1<br>**Fault 018**<br>*Terminal fault, the boiler will not fire* | Inverter for secondary 1 air fan reports a fault<br>• Fan is isolated<br>• Inverter has a fault<br>• E.rHn | • Check the isolator is in the on position<br>• Obtain the fault code from the inverter and refer to the inverter manual<br>• Over Current |
| F: SECONDARY FAN 2<br>**Fault 019**<br>*Terminal fault, the boiler will not fire* | Inverter for secondary 2 air fan reports a fault<br>• Fan is isolated<br>• Inverter has a fault | • Check the isolator is in the on position<br>• Obtain the fault code from the inverter and refer to the inverter manual |
| F: ID FAN<br>**Fault 020**<br>*Terminal fault, the boiler will not fire* | Inverter for ID (cyclone) fan reports a fault<br>• Fan is isolated<br>• Inverter has a fault<br>• E.0U2 | • Check the isolator is in the on position<br>• Obtain the fault code from the inverter and refer to the inverter manual<br>• Re-Gen or voltage surge, set invertor parameter 882 to 1 |
| F:IGNITION<br>**Fault 101**<br>*Terminal fault, the boiler will not fire* | Automatic ignition failed twice<br>• No fuel<br>• Fuel is too wet or dusty, or does not flow through the augers<br>• Ignition element is broken | Remove excess fuel from the combustion chamber<br>• Fill silo if empty or very low. Ensure the augers are pre-filled before starting the boiler<br>• Use a fuel that meets the fuel specification<br>• Replace the ignition gun |

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| W:NO FIRE<br>**Fault 102**<br>*Warning fault, the boiler will continue* | Flame monitoring reports that the fire went out .The fire room temperature or flue gas temperature are too low, the boiler has been forced to reignite automatically.<br>• Fuel used is too wet or of poor quality<br>• Fuel values are adjusted incorrectly | Check fuel level in store, refill as necessary.<br>• Check fuel moisture and size meet the specification<br>• Re-commissioning required |
| W:FLUE GAS LOW<br>**Fault 103**<br>*Fault is terminal boiler will stop* | The flue gas temperature has dropped below the minimum<br>• Fuel used is too wet or of poor quality<br>• Tube cleaning valves are adjusted incorrectly<br>• Boiler Fire out | Check fuel level in store, refill as necessary.<br>• Check fuel moisture and size meet the specification<br>• Re-commissioning required<br>• Check and re-start |
| W:FLUE GAS HIGH<br>**Fault 104**<br>*Warning fault, the boiler will continue* | The flue gas temperature is too high, and the output has been reduced.<br>• The heat exchanger is dirty or obstructed<br>• Tube cleaning valves are adjusted incorrectly | Check fuel level in store, refill as necessary.<br>• Stop the boiler and manually clean the heat exchanger<br>• Re-commissioning of cleaning system required |
| F:UNDERPRESSURE<br>**Fault 105**<br>*Fault is terminal boiler will stop* | Under pressure was below the minimum for more than 30 seconds.<br>• Ash bin left uncoupled<br>• Door or lid left unsealed<br>• Chimney system obstructed<br>• Fault with boiler ID fan or inverter (unique fault code will be generated see above)<br>• Detachment / blockage of sample tube | • Securely clamp the ash bin in position<br>• Check doors and all removable flaps for air tightness<br>• Check and clean chimney as required<br>• Check for occurrence of fault 020.<br>• Check the sample tube is connected to the test point. / check for blockage by blowing through in direction of boiler. DON NOT BLOW INTO THE SENSOR |
| F:FUEL STORE TEMP<br>**Fault 106**<br>*Fault is terminal boiler will stop* | The sensor on the fuel store auger has reported an elevated temperature.<br>• The auger thermostat is faulty or wired incorrectly<br>• Burn back has reached the fuel store auger | • Replace auger thermostat<br>• Isolate equipment. If safe to do so, check if the water tanks have emptied. Check the fuel store. Call the fire department if necessary. |
| F:STB TRIP<br>**Fault 107**<br>*Fault is terminal boiler will stop* | The safety temperature breaker has been activated. Boiler water temperature has exceeded 95℃<br>• Insufficient circulation<br>• Insufficient load (for equipment without buffer tanks) | Let the boiler cool to 70℃ and reset the STB (unscrew black plastic cap and depress with pointed object)<br>• Check pumps, valves and strainers allow circulation<br>• Avoid running the boiler if loading is minimal and a buffer tank is not installed.<br>• See fault 110 / 111 |

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| | • Fault with the mains supply<br>• Fuel settings are incorrect | • Re-commissioning required |
| F:ASH BOX<br>**Fault 108**<br>*Fault is terminal boiler will stop* | The ash can door is open or ash can is removed<br>• Ash can lid / outer door opened<br>• Ash bin removed | • Replace lid / close door, ensure the switch is activated<br>• Replace the ash can |
| F:FIRE CHAMBER DOOR<br>**Fault 109**<br>*Fault is terminal boiler will stop* | The combustion chamber door has been opened | • Close combustion chamber door and secure tightly<br>• Clear the fault and restart the boiler |
| W:POWER OUTAGE<br>**Fault 110**<br>*Warning fault, the boiler will continue* | The boiler has recovered from a power outage. Avoided running the boiler if regular outages are anticipated | • Always shut the boiler down manually before any planned power outages |
| F:PHASE FAULT<br>**Fault 111**<br>*Fault is terminal boiler will stop* | Fault with the mains electrical supply<br>• Power cut has caused voltage spike<br>• Phase in the power supply was temporarily interrupted or unbalanced<br>• Phase in the power supply is cut off or unbalanced | • Reboot the boiler and clear the fault<br>• Reboot the boiler and clear the fault. Avoid excessive loading of a single phase<br>• Only qualified personnel can check the mains supply |
| F:WATER PRESSURE<br>**Fault 112**<br>*Fault is terminal boiler will stop* | Low / high water pressure in the heating system. External system is giving a stop signal to the boiler for safety reasons<br>• Pressure unit (or switch) reports low or high water pressure | • Check pressurisation unit or BMS for fault light. Rectify the pressure fault and then clear the fault on the boiler before restarting |
| W:O2 REGULATION<br>**Fault 113**<br>*Warning fault, the boiler will continue* | Fault with oxygen regulation. Target $O_2$ level could not be reached within the set time. Lambda correction is deactivated.<br>• Lambda probe is blocked with dust<br>• Fuel has changed from commissioning fuel.<br>• Lambda probe defective | Check the following and clear the fault to restart lambda correction.<br>• Remove probe and clean by blowing. Do not poke anything inside the probe<br>• Re-commissioning is required. Raise O2 set point<br>• Replace the probe (yearly replacement recommend) |
| W:Lambda learning<br>**Fault 114**<br>*Warning fault, the boiler will continue* | The control system has automatically adjusted the fuel settings.<br>• The system has recently been commissioned<br>• The fuel has changed significantly<br>• The oxygen reading is not correct | • The system is fine tuning itself and the fault can be cleared<br>• Observe operation of the boiler in all phases. Ensure the fire bed is the correct size<br>• Remove probe and clean by blowing. Do not poke anything inside the probe |
| F:RECIRCULATION FLAP | The recirculation flap is not closing | |

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| **Fault 115**<br>*Fault is terminal boiler will stop* | • Wiring fault<br>• Actuator defective | • Check the wiring<br>• Replace the actuator if required |
| F:PUMP FLOW FAILURE<br>**Fault 116**<br>*Fault is terminal boiler will stop* | The primary pump DPS reports no flow when the pump is activated<br>• Pump isolated<br>• Valve closed or strainer blocked<br>• Pump failed | <br>• Check the isolator is on<br>• Check all valves and strainers<br>• Test the pump / replace |
| F:WALKING FLOOR 1<br>**Fault 117**<br>*Fault is terminal boiler will stop* | Stage 1 of the walking floor is not moving to the end position<br>• Sensor not positioned correctly<br>• The walking floor is jammed by a foreign object | <br>• Re-position the sensor<br>• Shut the boiler down and clean the combustion grate |
| F:WALKING FLOOR 1<br>**Fault 118**<br>*Fault is terminal boiler will stop* | Stage 1 of the walking floor is not moving to the end position<br>• Sensor not positioned correctly<br>• The walking floor is jammed by a foreign object | <br>• Re-position the sensor<br>• Shut the boiler down and clean the combustion grate |
| F:BOILER TEMP<br>**Fault 201**<br>*Fault is terminal boiler will stop* | Boiler temperature probe broken | • Check electrical connection<br>• Replace boiler temperature probe |
| F:BUFFER TOP<br>**Fault 202**<br>*Fault is terminal boiler will stop* | Buffer temperature probe broken (top) | • Check electrical connection<br>• Replace buffer temperature up probe |
| W:BUFFER BOTTOM<br>**Fault 203**<br>*Warning fault, the boiler will continue* | Buffer temperature probe broken (bottom) | • Check electrical connection<br>• Replace buffer temperature down probe |
| F:BACKFLOW TEMP<br>**Fault 204**<br>*Fault is terminal boiler will stop* | Return temperature probe broken | • Check electrical connection<br>• Replace return temperature probe |
| F**:**STOKER TEMP<br>**Fault 205**<br>*Fault is terminal boiler will stop* | Stoker screw probe broken | • Check electrical connection<br>• Replace stoker screw probe. |
| F:FIRE TEMP<br>**Fault 207**<br>*Fault is terminal boiler will stop* | Fire temperature probe broken | • Check electrical connection<br>• Replace fire temperature probe |
| W:FLUEGASTEMP<br>**Fault 208**<br>*Warning fault, the boiler will continue* | Flue gas temperature probe broken | • Check electrical connection<br>• Replace flue gas temperature probe |
| F:UNDERPRESSCELL<br>**Fault 209**<br>*Fault is terminal boiler will stop* | Under pressure sensor defective | • Check electrical connection<br>• Replace under pressure sensor if required |
| F:LAMBDA DEFECTIVE<br>**Fault 210**<br>*Fault is terminal boiler will stop* | Lambda sensor defective | • Check electrical connection<br>• Replace lambda sensor |
| W:BACK END PROTECTION | Required return water temperature | • Check correct function of 3-port |

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| **Fault 211**<br>*Warning fault, the boiler will continue* | could not be attained during operation of the boiler | motorised mixing valve.<br>• Check position of return sensor to ensure accurate reading |
| F:OVERTEMP<br>**Fault 302**<br>*Fault is terminal boiler will stop* | Boiler temperature over 95 ℃<br>• Low water pressure<br>• Circulation problem<br>• 3 port return mixing valve defect<br>• Control hysteresis set too high<br>• Boiler maximum set too low | • Check water pressure. Fill if required<br>• Check all valves pumps and strainers, bleed air<br>• Check function of return mixing valve<br>• Reduce control hysteresis<br>• Increase boiler maximum |
| W:FROST STAGE 1<br>**Fault 303**<br>*Warning fault, the boiler will continue* | The controller has initiated stage 1 frost protection and has started the shunt pump<br>• Any connected temperature sensor reads below 4ºC | |
| W :FROST STAGE 2<br>**Fault 304**<br>*Warning fault, the boiler will continue* | The controller has initiated stage 2 frost protection and has released the boiler to fire<br>• Boiler temperature sensor reads < 2ºC | |
| Emergency Stop Operated<br>**Flt.305** | • Emergency Initiated, everything will stop giving rise to a potentially dangerous scenario with all safety functions disabled. | • Inspect installation for reasons the stop was pressed.<br>• Release the stop button & reset to enable burnout. |
| Door Open Fault<br>**Flt.306** | • The combustion chamber door has been opened | • Close combustion chamber door and secure tightly<br>• Clear the fault and restart the boiler |
| External Pump 1 Fault<br>**Flt.307** | • External Pump 1 has a fault Fault | • Inspect pump 1 to determine fault<br>• Clear the fault and restart the boiler |
| External Pump 2 Fault<br>**Flt.308** | • External Pump 2 has a fault Fault | • Inspect pump 2 to determine fault<br>• Clear the fault and restart the boiler |
| External Pump 3 Fault<br>**Flt.309** | • External Pump 3 has a fault Fault | • Inspect pump 3 to determine fault<br>• Clear the fault and restart the boiler |
| Fuel Request Time Out<br>**Flt.310** | • The boiler has run out of fuel and has needed to shutdown | • Inspect fuel delivery system<br>• Clear the fault and restart the boiler |
| Flue Gas Ex-High Alarm<br>**Flt.311** | | |
| Ceramic Filter Damper FTC<br>**Flt.312** | | |
| Ceramic Filter Blocked<br>**Flt.313** | | |
| Bunker Vibrator Fault<br>**Flt.314** | | |
| Filter Fire<br>**Flt.315** | • Boiler will bypass filter and put the boiler into an emergency shutdown | • Inspect filter for damage when safe to do so. |

**3.1) Regular Maintenance Schedule for Talbott's Boiler Plant**

**For continued compliance with all regulatory and warranty requirements it is important that your Talbott MWE biomass system is routinely serviced and maintained in line with the authorised maintenance schedule. The MWE system must be serviced by an approved/authorised service agent, as approved by Talbott's Biomass Energy Systems Ltd.**

IMORTANT NOTICE – ALL CLEANING FREQUENCIES ARE A GUIDE ONLY. Many factors affect the frequency of cleaning required, including fuel quality, dust / chip ratios, fuel moisture, boiler loading factors and seasonal variations etc. It is recommended that the schedule below is used as a starting point. Cleaning intervals can gradually be increased until a suitable pattern can be established for your particular plants operating conditions. It is the responsibility of the customer to ensure that cleaning is carried out at suitable frequency to suit the operating conditions of the plant.

| **Item** | **Frequency** |
|---|---|
| **Chimney** | |
| 1. Sweep internal bore of chimney and remove all deposits after. | 6 months |
| **Flue pipe** | |
| 2. Sweep all internal passageways and remove deposits. | 6 months |
| **I/D Fan** | |
| 3. Check for excessive Vibration (clean impeller if required) | Weekly |
| 4. Clean fan impeller with a wire brush | 3 Months |
| 5. Clean internal area of scroll. | 3 Months |
| **Cyclone Grit Arrestor (if Fitted)** | |
| 6. Clean out cyclone cells and all internal surfaces | 6 Weeks |
| 7. Empty Cyclone ash bin | Weekly |
| 8. Check condition of bin rope seals and replace in necessary | 6 Weeks |
| **Heat Exchanger** | |
| 9. Clean boiler tubes manually with cleaning brush. | 6 Weeks |
| 10. Clean out flue box at back of heat exchanger. | 6 Weeks |

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| 11. Remove and clean oxygen sensor | 6 Weeks |
| 12. Inspect Pressure relief valve for leaks | 6 Weeks |
| 13. Inspect and Clean pressure valve internally | 12 Months |
| 14. Check condition of door rope seals and replace in necessary | 6 Weeks |
| 15. Check tube cleaning valves for operation | 3 Months |
| 16. Drain compressed air manifolds | 3 Months |

**Combustion chamber**

| | |
|---|---|
| 17. Clean sight glass | Weekly |
| 18. Remove build-up of ash on and under the walking floor | Weekly |
| 19. Check condition of retort arch bricks etc | 6 Weeks |
| 20. Check and clean auto ignition tube | 6 Weeks |
| 21. Check and clean grate holes | 6 Weeks |
| 22. Check condition of door rope seals and replace in necessary | 6 Weeks |
| 23. Grease bearings for moving floor mechanism with high temp grease | 3 Months |

*frequent checking of the inside of the combustion chamber is required to ensure that the boiler is operating correctly. Initially it is required that the boiler is stopped, cooled down and inspected at least once a week. Air holes both in the grate and above it must remain clear to allow proper combustion and prevent damage to the unit. In most cases the automatic cleaning systems will cope without intervention. In this case, inspection / cleaning intervals can gradually be increased to suit the plant.

**Flue Gas Re-Circ System**

| | |
|---|---|
| 24. Check operation of both mixing dampers | 6 Weeks |
| 25. Sweep re-circ pipework and mixing box | 6 Months |

**De-ash System**

| | |
|---|---|
| 26. Empty ash bin | Weekly |
| 27. Inspect screw for damage | 6 Weeks |
| 28. Check gearbox for oil leaks | 6 Months |
| 29. Change Gearbox Oil | 12 Months |
| 30. Clean or Replace Gearbox Vent Plugs | 12 Months |
| 31. Grease end bearings | 6 Months |
| 32. Check condition of door rope seals and replace in necessary | 6 Weeks |

**Stoker**

| | |
|---|---|
| 33. Clean infrared sensors and Perspex panels | 6 Weeks |
| 34. Check gearbox for oil leaks | 6 Months |
| 35. Change Gearbox Oil | 12 Months |
| 36. Clean or Replace Gearbox Vent Plug | 12 Months |
| 37. Check water douse valve hasn't operated replace if leaking | Daily |
| 38. Flush water douse Valve seat | 12 Months |

**Rotary Valve**

| | |
|---|---|
| 39. Inspect blades of rotary valve replace as necessary | 6 Weeks |
| 40. Check gearbox for oil leaks | 6 Months |
| 41. Change Gearbox Oil | 12 Months |
| 42. Clean or Replace Gearbox Vent Plug | 12 Months |
| 43. Grease end bearings | 6 Months |

**Transport Screw**

| | |
|---|---|
| 44. Inspect flights above rotary valve for damage | 6 Weeks |
| 45. Check gearbox for oil leaks | 6 Months |
| 46. Change Gearbox Oil | 12 Months |
| 47. Clean or Replace Gearbox Vent Plug | 12 Months |
| 48. Grease end bearings | 6 Months |

**Silo**

| | |
|---|---|
| 49. Brush down inside of silo, remove accumulated dust | 12 Months |
| 50. Check gearbox for oil leaks | 6 Months |
| 51. Change Gearbox Oil | 12 Months |
| 52. Clean or Replace Gearbox Vent Plug | 12 Months |
| 53. Grease Thrust bearing | 12 Months |
| 54. Check correct operation and grease scraper arms | 12 Months |
| 55. Check condition of explosion panel | 12 Months |

**Control panel**

| | |
|---|---|
| 56. Remove and blow out control panel filters with compressed air | 6 Weeks |
| 57. Check all sensor values in status display are within normal parameters* | Daily |
| 58. Check high and low pressure switches for operation and reset | 6 Months |
| 59. Check operation of boiler over temp stat | 6 Months |

*Significant changes in fuel cannot be compensated for automatically and could lead to loss of performance or excessive heat output causing damage to components. The unit should be checked frequently to ensure all values are within safe parameters.

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| 60. Check for presence any faults in the fault log* | Daily |

*under pressure faults indicate that boiler tubes and or chimney / cyclone ducts need to be cleaned out

**Pipework**

61. Please refer to Suppliers instruction.

### 3.2) Regular Maintenance checklist

| Maintenance task number (s) | Date completed | Trained operator signature | Comments |
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### 3.2) Regular Maintenance checklist

| Maintenance task number | Date completed | Trained operator signature | Comments |
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## 3.2) Regular Maintenance checklist

| Maintenance task number | Date completed | Trained operator signature | Comments |
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### 3.2) Regular Maintenance checklist

| Maintenance task number | Date completed | Trained operator signature | Comments |
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### 3.3) Health & Safety

- We recommend the use of protective overalls, protective boots, gloves, goggles and a breathing mask, to be worn by operatives cleaning the heater.

- If work needs to be carried out in the combustion chamber, a suitable breathing mask should be used, and a lookout positioned at the heater, in case of emergencies. Work should not commence until the heater has cooled sufficiently, normally 24hrs. The cool down function can be used to facilitate this, see page

- If ladders are used, the ladders must be inspected and safe to use. We recommend an additional operative to steady the ladders.

- Before any work is undertaken, the isolator, on the control panel, must be shut down and locked. The operative should keep the key in their pocket, until the work is completed.

**3.4) PPE**

During contact with the unit PPE must be worn in accordance with Health and Safety Regulations in order to minimise health risks.

- **Protective Clothing**
  Protects users from entrapment in moving parts. Jewellery should not be worn.
- **Safety Shoes**
  Protects user from heavy fallen or dropped objects and aids grip on wet surfaces.
- **Safety Gloves**
  Protects hands from abrasions and hot surfaces.
- **Protective Goggles**
  Protects eyes from flying debris and splashes of liquid.
- **Light Breathing Protection**
  Protect from health damaging dust.

**3.5) Parts and Servicing**

***Replacement Parts and Accessories***

Only purchase genuine replacement parts from the manufacturer or through authorised dealers unless instructed by the manufacturer. Spare parts prices can be provided upon request by contacting Talbott's Service Department, please refer to contact details contained within this manual. Ensure you have the model and serial number in advance and if contacting by email it's advised to send a digital photo to assist in identification. Modifications should not be made to the unit without the manufacturer's written permission.

***Servicing Your Unit***

If a fault occurs with the unit that cannot be identified using this manual or you have a question of a technical nature then please contact Talbott's Service Department for assistance. Talbott's have engineers who operate throughout the UK and abroad. Your unit must be serviced by an authorised Talbott's engineer a minimum of twice per year to meet health and safety requirements but ideally quarterly servicing, depending on usage. Please contact the service department for prices, availability and servicing contracts.

**3.6) Service Request Order Form for Replacement Parts**

| | |
|---|---|
| **Company Name** | |
| **Contact Person** | |
| **Address** | |
| **Telephone** | |
| **Fax Number** | |
| **E-mail** | |
| **Unit Model** | |
| **Serial Number** | |
| **P/O Number** | |

| **Quantity** | **Part Name/Description** | **Price per unit if quoted** | **Amount** |
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| | | **Total** | |

**Print Name** …… **Signature** …… **Date** ……..

**4.2) Training Checklist**

Name of person(s) trained ……

Please tick the following boxes to confirm that you have received adequate training and understand the function and correct use of the following system components

**Main Boiler Control panel isolation switch** ☐

Location
Lock down procedure
When to use

**Emergency stop** ☐
Location
When to use

**HMI control Panel (touch screen)** ☐
Location
Navigation and use
User adjustable set points – location and function

**Repairs and maintenance procedure** ☐
Correct shut down and electrical shut off procedure
Trained personnel only
Correct use of any equipment
Protective clothing
Regular maintenance schedule
Health and safety

**Associated plant and pipe system** ☐
Function of all major system components
Location and use of control panels for associated components
Required condition of all associated components prior to starting boiler
Fuel bunker – avoiding overfills

**Manual** ☐
Operator's regular maintenance schedule
Health and Safety

**Removable guards, access hatches, flaps and doors** ☐
Stoker screw
Bunker / transfer auger screw(s)
Heat exchanger doors
Combustion chamber door
Under grate clean out doors
Silo access hatch
Grit arrester

Signed by trainer ……

Signed by trainee ……

Date ……

**Section 5 – Fuel bunker Health and Safety Notice**

On the 5th November 2012 the Health and Safety Executive issued a notice: Bulletin number OPSTD 3-2012 "Risk of carbon monoxide release during the storage of wood pellets" Please see to follow details of this notice or follow link:
http://www.hse.gov.uk/safetybulletins/co-wood-pellets.htm

Introduction:

The HSE is issuing this notice to those who use, install, maintain or distribute wood pellet boilers or manufacture/store/distribute wood pellets. Since 2002 there have been at least nine

fatalities in Europe caused by carbon monoxide poisoning following entry into wood pellet storage areas. Although there have not been any incidents so far in the UK the use of wood pellets is increasing and awareness of this danger is required. Wood pellet boilers are used in homes and businesses as an alternative to oil or gas fired boilers. They are also being installed to replace coal-fired boilers, particularly in schools.

Carbon monoxide can kill quickly without warning. It is a colourless, odourless and tasteless gas that is highly toxic. When carbon monoxide enters the body, it prevents the blood from bringing oxygen to cells, tissues, and organs.

## Background

Wood pellets are made from dried and milled sawdust and wood shavings that have been compressed into pellets, typically 10-20mm long and 3-12mm in diameter. They do not typically contain any additives or binders.

They are classed as a biofuel, a non-fossil heating fuel. The main countries of manufacture are Canada, North America and the Scandinavian countries within Europe. In 2000, the annual production of wood pellets in Europe and North America was about 1.5 million tons. This was expected to increase to around 16 million tons by 2011[1]. Some wood pellet manufacture is now taking place in the UK.

## Fatality details

Fatalities caused by the release of carbon monoxide from wood pellets have previously been reported[2] in Europe following personnel entering ships cargo holds (four) or storage silos (two).
Since 2010 there have also been three deaths caused by entry into wood pellet storage facilities in domestic sites[3]. Two were associated with a work activity and the other was a householder. In each case, the entry had been to resolve a technical problem. Details:

- In January 2010, a 43-year-old engineer died in Germany after he opened a pellet bunker door. A second worker who was standing right behind him was also affected but still able to call the emergency services. The pellet bunker had a storage capacity of approximately 155 tonnes of pellets, supplying about 700 households.
- In November 2010 a 38-year-old male householder in Ireland died after entering the 7 tonne wood pellet storage room for his boiler. His wife and another man were treated in hospital after trying to pull him to safety.
- In February 2011, the 28-year-old pregnant wife of a caretaker, acting on his behalf, died in Switzerland after entering an 82m3 pellet store room that supplied 60 households.

## Factors affecting the amount of carbon monoxide released from wood pellets

Wood pellets for boilers are normally stored in a large sealed hopper/tank or a storage room that has a screw feeder (auger) connected to the boiler. Alternatively, the hopper/tank can be mounted over the boiler for gravity feeding. Due to the enclosed nature of these hoppers/tanks/rooms, the atmosphere inside can become oxygen depleted and a toxic atmosphere containing carbon monoxide can accumulate. The chemical reactions responsible for carbon monoxide production from wood pellets are assumed to be an auto-oxidation process, especially oxidation of the fatty acids to be found in wood[4].
Experimentation has shown[3] that small quantities of wood pellets can produce life-threatening quantities of carbon monoxide in a confined space and that there are various factors that will affect the amount of carbon monoxide produced:

- Age - pellets will produce more carbon monoxide within the first six weeks of being manufactured.
- Temperature - more carbon monoxide is produced at higher temperatures.
- Wood type - pellets made from pine contain more unsaturated fatty acids than spruce so produce more carbon monoxide.
- Other factors - carbon monoxide levels will also increase with the amount of available oxygen present, exposed pellet surface area and amount of mechanical abrasion of the pellets that has taken place.

Note: In addition to the risk of carbon monoxide from wood pellets there is also a possibility of carbon monoxide being present because of a back-flow of flue gases via the fuel supply mechanism from the boiler. Causes for this include inadequate equipment being installed or a poorly designed flue.

Action required:

The HSE is advising all those who use, install, maintain or distribute wood pellet boilers and/or manufacture/store/distribute wood pellets to consider the following:

- Wood pellet hoppers/tanks/storage rooms and boilers should always be installed and commissioned by a competent person, normally approved by the manufacturer/supplier. This is particularly important if the installation involves the replacement of a coal-fired boiler, where existing boiler room and storerooms are often utilised.
- Do not enter the pellet storage area or place your head into a wood pellet hopper as they can contain toxic gases. No personnel should enter the hopper/tank unless fully trained and competent in confined space entry procedures. Controls should be put in place to ensure safe entry as per the HSE's Code of Practice for Working in Confined Spaces[5]. This should include adequately ventilating the storage area and checking carbon monoxide and oxygen levels with an appropriate device prior to entry. It is recommended that the store room is ventilated at all times, either mechanically or by being designed to have a through draft.
- Ensure that the boiler and pellet feed mechanism etc. is cleaned and serviced by a competent person as specified by the manufacturers' instructions.
- If any problems are encountered with the unit, such as the system not heating correctly or flue gas is flowing into the boiler room, turn the unit off and contact the supplier and/or manufacturer and request assistance.
- Duty holders who store wood pellets, particularly in bulk should have a suitable risk assessment and safe system of work in place.
- Manufacturers, suppliers and distributors of wood pellets should provide adequate health and safety information to the user in their materials safety data sheet.
- Warning signs should be placed on the pellet storage area access door, ideally on both sides so it can be seen when the door is open. The warning sign should include the following information:

  - DANGER - RISK OF CARBON MONOXIDE POISONING - There is a danger to life from odourless carbon monoxide and lack of oxygen. Check atmosphere before entry with an appropriate device. No entry for unauthorised persons. Keep children away from the storeroom.
  - No smoking, fires or naked flames.
  - The room should be adequately ventilated before entering. Keep the door open whilst inside.
  - There is a danger of injury from movable parts.
  - Filling procedures should be carried out accordance to the instructions of the heating installation company and the pellet suppliers

## 7.1) Boiler Cleaning Valves

### MAINTENANCE

Periodic cleaning is recommended, the timing of which will depend on the media and service conditions. Dis/Reassemble parts in an orderly fashion. Pay careful attention to exploded views provided for identification and placement of parts, and refer to the separate I&M sheet for disassembly of the solenoid. During servicing, components should be examined for excessive wear. A complete set of internal parts is available as a spare parts or rebuild kit. If a problem occurs during installation/maintenance or in case of doubt please contact ASCO Numatics or its authorized representatives.

CAUTION:

depressurize system, before servicing valve.

2. Keep the air flowing through the tank system as free from dirt and foreign materials as possible.
3. For reassembly of the parts apply the right torque according to torque chart.

### VALVE DISASSEMBLY

Disassemble in an orderly fashion. Pay careful attention to exploded views provided for identification of parts.

1. Use a screwdriver or torx no. 30 to unscrew 3 screws and to remove the bonnet from the valve.
2. Remove insert seat, silencer, o-ring, core assembly and spring in the correct order with the help of a screwdriver (see figure 1).
3. Remove the piston-assembly with the help of a screwdriver (see figure 2).
4. Unscrew the clamps if necessary and remove pipes if necessary and in that case remove the pipe O-rings from the body with a suitable device.
5. All parts are now accessible for cleaning or replacement.

### VALVE REASSEMBLY

Reassemble in reverse order of disassembly paying careful attention to exploded views provided for identification and placement of parts.

1. NOTE: Lubricate all gaskets/O-rings with high quality silicone grease.
2. If valve has been removed, tighten screws of the clamps according to torque chart.
3. Hold bonnet-assy upside down to place inner parts.
4. Place o-ring into the groove of the bonnet acc. fig. 3.
5. Replace spring and core-assy into the bonnet-assy acc. fig. 3.
6. Place silencer over the insert seat and press both the parts firmly into the bonnet-assy acc. to fig. 3.
7. Replace piston-assembly in body.
8. Replace the bonnet and screws. Use a screwdriver or a torx no. 30 to tighten screws. Apply the right torque according to torque chart.
9. After maintenance, operate the valve a few times to be sure of proper operation.

### SPARE PART / OPTIONAL KITS

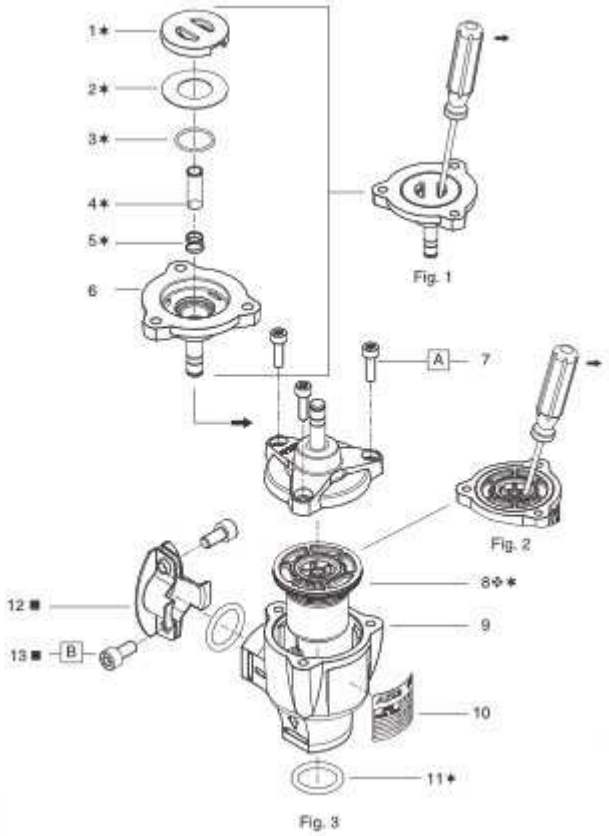
Several parts are available as kits as specified in the kit table.

### CAUSES OF IMPROPER OPERATION

- Incorrect pressure: Check tank system pressure. Pressure to tank system must be within range specified on nameplate of the valve.
- Excessive leakage: Disassemble valve and clean parts or install a complete ASCO spare parts kit.
- Incorrect pulse: Disassemble the pilot and clean or replace silencer

### COIL REPLACEMENT

Refer to separate I&M sheet for solenoid for coil replacement.




1. Insert Seat
2. Silencer
3. O-Ring, Insert Seat
4. Core-Assy
5. Spring
6. Bonnet-Assy, Int. Pilot. Ext. Exhaust
7. Screw, Thread Rolling (3x)
8. Piston Sub-Assy
9. Body QM
10. Name Plate
11. O-Ring, Body (2x)
12. Clamp (2x)
13. Screw, Hex. Socket Head Cap (2x)

| TORQUE CHART | | | |
|---|---|---|---|
| A | | 7 ± 1 | 62 ± 9 |
| B | ¾ | 10 ± 2 | 90 ± 20 |
| B | 1 | 16 ± 2 | 140 ± 20 |
| ITEMS | | NEWTON.METRES | INCH.POUNDS |

## 7.2) Gearbox Maintenance

| | MWE 199 | MWE 300 | MWE 600 | MWE 999 |
|---|---|---|---|---|
| De ash screw | TH 21 | TH 21 | TH 25 | TH 25 |
| Bunker | TH 17 (10 rpm) + TH 18 | TH 17 (10 rpm) + TH 18 | TH 17 (24 rpm) + TH 18 | TH 17(24 rpm) + TH 18 |
| Mooving floor | Th 26 | Th 27 | TH 27 | TH 27 |
| Stoker | TH 23 | TH 23 | TH 24 | TH 24 |
| Rotary valve | THRV | THRV | THRV | THRV |

| Gear Box Ref | Plate Type | Oil Ltr |
|---|---|---|
| TH RV | CLP 220 | 1.0 |
| TH 17 | CLP 220 | 1.6 |
| TH 18 | CLP PG 680 | 6.3 |
| TH 21 | | |
| TH 23 | | |
| TH 24 | CLP 220 | 2.3 |
| TH 25 | CLP PG 680 | 1.1 |

| | | |
|---|---|---|
| TH 26 | | |
| TH 27 | CLP PG 680 | 1.0 |

**Note!**

After changing the lubricant, and in particular after the initial filling, the oil level may change during the first few hours of operation, as the oil galleries and hollow spaces only fill gradually during operation. The oil level is still within the permissible tolerance.

If at the express request of the customer, an oil inspection glass is installed at an additional charge, we recommend that the customer corrects the oil level after an operating period of approx. 2 hours, so that when the gear unit is at a standstill and has cooled down, the oil level is visible in the inspection glass. Only then, is it possible to check the oil level by means of the inspection glass.

The filling quantities stated in the following tables are for guidance only. The precise quantities vary depending on the exact gear ratio. When filling, always observe the oil level screw hole as an indicator of the precise quantity of oil.

| Lubricant type | Details on type plate | DIN (ISO) / Ambient temperature | bp | Castrol | FUCHS | KLÜBER LUBRICATION | Mobil | |
|---|---|---|---|---|---|---|---|---|
| **Mineral oil** | CLP 680 | ISO VG 680<br>0...40°C | Energol GR-XP 680 | Alpha EP 680<br>Alpha SP 680<br>Optigear BM 680<br>Tribol 1100/680 | RENOLIN CLP 680<br>RENOLIN CLP 680 Plus | Klüberoil GEM 1-680 N | Mobilgear 600 XP 680 | Omala S2 G 680 |
| | CLP 220 | ISO VG 220<br>-10…40°C | Energol GR-XP 220 | Alpha EP 220<br>Alpha SP 220<br>Optigear BM 220<br>Tribol 1100/220 | RENOLIN CLP 220<br>RENOLIN CLP 220 Plus | Klüberoil GEM 1-220 N | Mobilgear 600 XP 220 | Omala S2 G 220 |
| | CLP 100 | ISO VG 100<br>-15…25°C | Energol GR-XP 100 | Alpha EP 100<br>Alpha SP 100<br>Optigear BM 100<br>Tribol 1100/100 | RENOLIN CLP 100<br>RENOLIN CLP 100 Plus | Klüberoil GEM 1-100 N | Mobilgear 600 XP 100 | Omala S2 G 100 |
| **Synthetic oil (Polyglycol)** | CLP PG 680 | ISO VG 680<br>-20...40°C | - | Alphasyn GS 680<br>Tribol 800/680 | RENOLIN PG 680 | Klübersynth GH 6-680 | Mobil Glygoyle 680 | Omala S4 WE 680 |
| | CLP PG 220 | ISO VG 220<br>-25…80°C | Enersyn SG-XP 220 | Alphasyn GS 220<br>Alphasyn PG 220<br>Tribol 800/220 | RENOLIN PG 220 | Klübersynth GH 6-220 | Mobil Glygoyle 220 | Omala S4 WE 220 |
| **Synthetic oil (hydrocarbon)** | CLP HC 460 | ISO VG 460<br>-30…80°C | - | Alphasyn EP 460<br>Tribol 1510/460<br>Optigear Synthetic X 460 | RENOLIN Unisyn CLP 460 | Klübersynth GEM 4-460 N | Mobil SHC 634 | Omala S4 GX 460 |
| | CLP HC 220 | ISO VG 220<br>-40…80°C | - | Alphasyn EP 220<br>Tribol 1510/220<br>Optigear Synthetic X 220 | RENOLIN Unisyn CLP 220 | Klübersynth GEM 4-220 N | Mobil SHC 630 | Omala S4 GX 220 |

For further information please contact:-

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