13. PROCESS DATA MONITORING AND CONTROL

13.1. DOSING OF THE PELLETS

The three-stage dosing equipment weighs out pellets in batches á 20kg. A window in the lower stage allows for the visual inspection of the quality of the pellets at all times.

13.2. TEMPERATURE CONTROL IN THE REACTOR

There are eight temperature sensors at different heights of the reactor wall for monitoring the temperatures in the different reaction zones.

13.3. WOOD GAS TEMPERATURE

Check points of the temperature of the air flow and of the gas flow:

- Reactor inlet (ambient temperature)
- Reactor outlet (approx. 800°C)
- Outlet gas heat exchanger (approx. 120°C)
- Outlet gas filter (approx. 120°C)
- Outlet gas cooler (approx. 40°C)
  Outlet side-channel compressor to the CHP (approx. 50°C - 70°C)

13.4. WOOD GAS PRESSURE

Checkpoints of the wood gas pressure (ambient pressure 1013hPa):

- Reactor outlet (1004hPa)
- Outlet gas heat exchanger (1000hPa)
- Outlet gas filter (approx. 990hPa)
- Outlet gas cooler (975hPa)
- Outlet side-channel compressor to the CHP (1050hPa)

If a specified pressure difference through the filter is exceeded, the cleaning process is initiated. The remaining pressures are necessary for the process analysis via remote access.

13.5. GAS COMPOSITION

The composition of the wood gas is analysed after the gas compressor at the plant outlet to the combined heat and power plant. The contents of carbon monoxide, carbon dioxide and methane are measured.

THE MEASUREMENT RESULTS FROM 13.1. TO 13.5.
ARE AUTOMATICALLY RECORDED IN DIAGRAMS BY THE BURKHARDT CONTROL SYSTEM AND ARE THEN INCORPORATED IN THE PROCESS CONTROL.

13.6.AUTOMATIC VALVE REGULATION

The wood gas can be transported through three paths:
In normal operation, the wood gas flows to the CHP and is consumed there. If the motor fails, the gas is automatically conducted to the flare and burned there. If the emergency shutdown of the reactor becomes necessary, the gas is conducted in a cycle through the reactor, while its air supply is interrupted. The oxygen deficiency results in the stopping of the combustion and the pyrolysis. At the same time, the cooling down of the gas in the cycle results in the cooling down of the reactor and thus to a quicker shutdown of the gas generation process.

14. SAFETY PRECAUTIONS

14.1 PC WITH CONTROL SOFTWARE

PC WITH CONTROL SOFTWARE

- data exchange with the digital and analogue inputs of the PLC
- takes care of the visualisation of the data and receives user input
- carries out various logical tests, e.g.:
  – area monitoring sensors
  – runtime monitoring
  – availability of the PLC
- responds in case of critical conditions with “Warning”, automatic shutdown and “safety shutdown” (via software)
- informs the operator of critical plant conditions via e-mail/fax/text message
- response times: approx. 2s

PLC (PROGRAMMABLE LOGIC CONTROL)

- delivers digital and analogue data to the control software
- sends digital and analogue control commands of the control software to the hardware
- carries out some essential logical tests
- checks the availability of the control software on the PC
- responds in case of critical conditions with “safety shutdown” (PLC)
- Response time: 10ms + switching time of the relays and contactors

SAFETY PLC (APPROVED UP TO PERFORMANCE LEVEL E)

- processes the input of many safety-related sensors (s. 1.1.2)
- has preference over the functions of the PLC
- responds to safety-critical plant conditions with
- using safe contactor circuits deenergises all motors and depressurises all pneumatic valves
- Response time: 10ms + switching time of the relays and contactors

ON THE HARDWARE LEVEL

- operation of the gas generator and the gas cleaning system below ambient pressure (from -2mbar down) burnback prevention through purely mechanical fire extinguishing system with 30 litres of water for pellet supply and ash removal
- gas-tight locks in the pellet supply and ash removal
- all relevant valves are moved into safe position via spring reset
- safety valve after the reactor in the gas pipe to the flue (200mbar opening pressure)
- largest gas volume (filter) 10bar pressure surge-proof
- the gas production in the reactor stops almost completely within a very short time in case of a shutdown