Project:

WEST OFFALY POWER PEAT FIRED PLANT

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SYSTEM DESCRIPTION

FUEL FEEDING SYSTEM

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PROCESS DESCRIPTION OF FUEL INFEED TO THE BOILER

1. General

The fuel is transferred from two silos to the boiler in two basically similar lines (picture 1 and 2), both of which are fed by a silo reclaimer located at the beginning of the conveyor lines. Fuel is fed by these two conveyor lines into the boiler through total seven inlet points (5 inlets/front wall, 2 inlets/rear wall).

Picture 1. Peat feeding line (front wall)

Picture 2. Peat feeding line (rear wall)
2. Screw reclaimers (S1HHH01AF301 and S1HHH02AF301)

The reclaimer screw travels slowly around the centre passing over the reclaim area. As the screw rotates while travelling, stored material is transferred by the screw flight into the hub, where it falls through a discharge chute into a drag chain conveyor, located under the silo.

Capacity of the reclaimer screws are adjusted by a frequency converter controlled motors.
Total capacity of the front wall line varies from 92 to 920 m$^3$/h
Total capacity of the rear wall line varies from 36 to 360 m$^3$/h

The choked-flow detectors are provided to monitor the material flow in the outlet chute. If the choked-flow detectors get activated, the screw driving motor and the travel motor are both stopped.

3. Front wall feeding line process

3.1 Chain conveyor, front wall line (S1HHH05AF101)

The fuel from the screw reclaimer falls down onto the drag chain conveyor.
The fuel flows through the upper chain to the bottom of the conveyor for further conveying to the five boilers feed lines by a lower strand of the drag chain.

The capacity of the drag chain conveyor is adjusted by a frequency converter. The speed of the conveyor is adjusted according to the five boiler front wall feeding line capacities so, that all five feeding lines will get enough fuel.
Material bed height in the conveyor (filling degree) is kept constant by means of a special material bed equalizer, due to the high capacity of the chain conveyor.
The bed equalizer, which locates just after the inlet point of the chain conveyor, serves also as a fuel buffer stock, and the fuel level there is monitored by continuous level control system.
The continuous level control will fine adjust the capacity of the preceding screw reclaimer S1HHH01AF301, as feedback.

The capacity of the conveyor varies from 92 to 920 m$^3$/h.

A choked-flow detector is provided in the conveyor drive end to monitor a possible material jam. If the choked-flow detector gets activated, the chain conveyor and the preceding feeding line are stopped.
Malfunction in one of the boiler front wall feeding line (S1HHH10, S1HHH20, S1HHH30, S1HHH40 or S1HHH50), please see section 3.6.

3.2 Robbing screw conveyors (S1HHH10…, …20…, …30…, …40…, …50AF301)

The purpose of the four first robbing screw conveyors (10AF301, 20AF301, 30AF301 and 40AF301) is to "rob" the adjusted amount of fuel to the following feed line from the fuel flow in the drag chain conveyor.

The last one in the feeding line (50AF301) is equipped with a hopper (volume approx. 2 m$^3$), in which there will be held a constant fuel layer, controlled by a level indicator. This level indicator will give information for fine adjustment for the preceding feeding line.

The "robbing" capacity is adjusted by a frequency converter. The capacity of each screw can be adjusted from 20 to 200 m$^3$/h.

A choked-flow detector is mounted inside each screw conveyor at the outlet end. If a jam occurs, the choked-flow detector gives an alarm signal to the control centre and stops the robbing screw conveyor.

3.3 Rotary valve feeders (S1HHH10…, …20…, …30…, …40…, …50AF501)

The fuel from the robbing screw conveyors falls down into the rotary valve feeders for further transportation to the next screw conveyors.

The purpose of the rotary valve feeders is to pass through a desired flow of the fuel and simultaneously to minimise the airflow through resulting from the pressure differences.

Speed limit switch is provided for controlling the rotation speed of each rotary valve feeder. If the speed limit switch detects that the rotary valve feeder in line has stopped, it will send an alarm signal to the control centre and stop the rotary valve feeder, as well as the preceding robbing screw of the same feeding line.

In normal operation the capacity of each feeder is 140 m$^3$/h. Maximum capacity of each feeder is 200 m$^3$/h.
3.4 Screw conveyors (S1HHH10... , ...20..., ...30..., ...40..., ...50AF302)

Material coming from rotary valve feeders is transferred by these screw conveyors further to the boiler, via the expansion bellows, which will compensate the thermal expansions of the boiler itself.

A choked-flow detector is mounted inside each screw conveyor, at the outlet end. If a jam occurs, the choked-flow detector gives an alarm signal to the control centre and stops the screw conveyor, as well as the preceding rotary valve feeder and robbing screw conveyor in the same feeding line.

The rotation speed of these screw conveyors is constant. Maximum capacity of each screw is 200 m$^3$/h.

3.5 Manually operated slide gates

There are two manually operated slide gates on each boiler feeding line.
The first one is above each rotary valve feeder, and the other one is below each expansion bellow. These slide gates are always in completely opened position, during normal operation. Slide gate, the other one or both, will be closed only for service or repair purposes on the said feeding line of the boiler.

Slide gates above the rotary valve feeders:
S1HHH10AA001, ...20AA001, ...30AA001, ...40AA001, ...50AA001

Slide gates below the expansion bellows:
S1HHH10AA002, ...20AA002, ...30AA002, ...40AA002, ...50AA002
3.6 Malfunction in one of the boiler front wall feeding line

If there occurs, for some reason, a malfunction in one of the boiler front wall feeding lines (S1HHH20, S1HHH20, S1HHH30, S1HHH40 or S1HHH50), the complete line must not necessarily be stopped, starting from the silo reclaimer.

For such malfunction event, the chain conveyor S1HHH05AF101 is equipped with a carry over system, meaning that the return chain of the conveyor will return the excess amount of fuel on the return bottom between feeding points S1HHH20 / S1HHH30.

Malfunction model Nr. 1.

If one of the conveyors (screw or rotary valve feeder) on boiler feeding line S1HHH10, S1HHH20, S1HHH30, or S1HHH40 gets out of service - at the maximum two lines simultaneously, in this case the capacity of the reclaimer S1HHH01AF301 and the chain conveyor S1HHH05AF101 must be reduced immediately to correspond with the capacity of the four boiler feeding lines, which remains running (three, if two lines has stopped).

Please note:
If there are two of boiler front wall feeding lines out of service simultaneously, the combination of these two, between the lines S1HHH10...20...30...40, may be whichever.

But now at first, in the chain conveyor there is fuel for all five boiler feeding lines, so basically it is overfilled now when there are only four (three) feeding lines in operation.

Part of this “excess fuel” goes into the hopper of the robbing screw S1HHH50AF301, and the hopper will be filled completely eventually.

After the hopper is full, the rest of the fuel will be returned by the carry over system backwards between the feeding lines S1HHH20 and S1HHH30.

After a while, when the reclaimer and chain conveyor capacities has been balanced with the four (three) remaining boiler feed line capacities, then will at first stop the fuel going to the carry over system of the chain conveyor and after that will the fuel layer drop to the normal level in the hopper of the last robbing screw.
Malfunction model Nr. 2.

If one of the conveyors (screw or rotary valve feeder) on boiler feeding line S1HHH50 gets out of service, also in this case the capacity of the reclaimer and the chain conveyor will be reduced immediately to correspond with the capacity of the four boiler feeding lines, which remains running (S1HHH10, 20, 30, 40).

The overfilling of the chain conveyo is just as described in malfunction model nr. 1.

In this case, at first, the “excess fuel” from the chain conveyor goes into the hopper of the robbing screw S1HHH50AF301, and the hopper will be rapidly filled completely.

After the hopper is full, the rest of the fuel will be returned by the carry over system backwards between the boiler feeding lines S1HHH20 and S1HHH30.

After a while, when the reclaimer and chain conveyor capacities has been balanced with the four remaining boiler feed line capacities, then will the amount of fuel going to the carry over system of the chain conveyor reduce, but it may not stop completely, because the hopper of the last robbing screw remains filled all the malfunction time.

Please note:
Simultaneously with line S1HHH50 there may also be one other boiler front wall feeding line out of service (S1HHH10, 20, 30, 40). In this case is the capacity reducing procedure quite the same, only now there remains only three boiler front wall feeding lines running, instead of four.

This way can the front wall line be run with, in minimum, three boiler front wall feeding lines operating.
After the reason for malfunction (model nr. 1 or nr. 2) has been solved and repaired, may the front line feeding process be returned to normal operation.
4. Rear wall feeding line process

4.1 Chain conveyor, rear wall line (S1HHH06AF101)

The fuel from the screw reclaimer falls down onto the drag chain conveyor. The fuel flows through the upper chain to the bottom of the conveyor for further conveying to the two boilers feed lines by a lower strand of the drag chain.

The capacity of the drag chain conveyor is adjusted by a frequency converter. The speed of the conveyor is adjusted according to the two boiler rear wall line capacities so, that both two feeding lines will get enough fuel. The material bed height in the conveyor (filling degree) will be kept as constant as possible.

The capacity of the conveyor varies from 36 to 360 m$^3$/h.

A choked-flow detector is provided in the conveyor drive end to monitor a possible material jam. If the choked-flow detector gets activated, the chain conveyor and the preceding feeding line are stopped.

In this chain conveyor there is no carry over system.

Malfunction in one of the boiler rear wall feeding line (S1HHH60, or S1HHH70), please see section 4.6.

4.2 Robbing screw conveyors (S1HHH60AF301 & S1HHH70AF301)

The purpose of the first robbing screw conveyor (60AF301) is to "rob" the adjusted amount of fuel to the following feed line from the fuel flow in the drag chain conveyor.

The second one in the feeding line (70AF301) is equipped with a hopper (volume approx. 2 m$^3$), in which there will be held a constant fuel layer, controlled by a level indicator. This level indicator will give information for fine adjustment for the preceding feeding line.

The "robbing" capacity is adjusted by a frequency converter. The capacity of each screw can be adjusted from 20 to 200 m$^3$/h.

A choked-flow detector is mounted inside each screw conveyor at the outlet end. If a jam occurs, the choked-flow detector gives an alarm signal to the control centre and stops the robbing screw conveyor.
4.3 Rotary valve feeders (S1HHH60AF501 & S1HHH70AF501)

The fuel from the robbing screw conveyors falls down into the rotary valve feeders for further transportation to the next screw conveyors.

The purpose of the rotary valve feeders is to pass through a desired flow of the fuel and simultaneously to minimise the airflow through resulting from the pressure differences.

Speed limit switch is provided for controlling the rotation speed of each rotary valve feeder. If the speed limit switch detects that the rotary valve feeder in line has stopped, it will send an alarm signal to the control centre and stop the rotary valve feeder, as well as the preceding robbing screw of the same feeding line.

In normal operation the capacity of each feeder is 140 m$^3$/h. Maximum capacity of each feeder is 200 m$^3$/h.

4.4 Screw conveyors (S1HHH60AF302 & S1HHH70AF302)

Material coming from rotary valve feeders is transferred by these screw conveyors further to the boiler, via the expansion bellows, which will compensate the thermal expansions of the boiler itself.

A choked-flow detector is mounted inside each screw conveyor, at the outlet end. If a jam occurs, the choked-flow detector gives an alarm signal to the control centre and stops the screw conveyor, as well as the preceding rotary valve feeder and robbing screw conveyor in the same feeding line.

The rotation speed of these screw conveyors is constant. Maximum capacity of each screw is 200 m$^3$/h.
4.5 Manually operated slide gates

There are two manually operated slide gates on each boiler feeding line. The first one is above each rotary valve feeder, and the other one is below each expansion bellow. These slide gates are always in completely opened position during normal operation. Slide gate, the other one or both, will be closed only for service or repair purposes on the said feeding line of the boiler.

Slide gates above the rotary valve feeders:
S1HHH60AA001, S1HHH70AA001

Slide gates below the expansion bellows:
S1HHH60AA002, S1HHH70AA002

4.6 Malfunction in one of the boiler rear wall feeding line

Malfunction model Nr. 1.

If one of the conveyors (screw or rotary valve feeder) on boiler rear wall feeding line S1HHH60 gets out of service, the complete line may not necessarily be stopped, starting from the silo reclaimer. In this case the capacity of the reclaimer S1HHH02AF301 and the chain conveyor S1HHH06AF101 must be reduced immediately to correspond with the capacity of the boiler feeding line S1HHH70, which remains running. This is to prevent plugging up the hopper of the robbing screw S1HHH70AF301.

Malfunction model Nr. 2.

If one of the conveyors (screw or rotary valve feeder) on boiler feeding line L1HHH70 gets out of service, in this case the complete line must be stopped immediately. Otherwise the hopper of robbing screw S1HHH70AF301 and the drive end of the chain conveyor S1HHH06AF101 will be jammed.

After the reason for malfunction has been solved and repaired, may the rear line feeding process be returned to normal operation.