BOSCH
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167 tons of steam for power plant giant Ledvice

Reference Report Bosch Industrial

Bosch supplies four double-flame tube boilers

The operator

The Ledvice power plant is situated in the Czech Republic at the foot of the Erz Mountains between the cities Teplice and Bílina and belongs to the energy company ČEZ. A new power plant unit with a formidable electrical power output of 660 megawatts has recently been put into operation at this site. The general contractor Škoda Praha Invest has implemented the turnkey system using the best technology currently available. According to the principle of combined heat and power generation, the waste heat produced during power generation is fed into the district heating network instead of simply being released unused into the atmosphere. Heat is supplied to roughly 300 companies and 20 000 inhabitants in total.

The project

Reliable and efficient provision is one of the most important factors in power plant operation. Anybody who has been faced to spend a day without heating and hot water in winter will quickly agree that a reliable supply is important! Bosch delivered a total of four gas-operated double-flame tube boilers of type ZFR-X with an impressive total output of 167 000 kilograms of steam per hour. They are used to start-up the new steam turbine (power generation) at the Ledvice power plant. Moreover, the huge boilers provide an additional supply of heat during peak load periods and serve as a backup. This redundancy ensures an extremely high degree of operating reliability at all times.

167 t/h steam for new power plant unit

- To start-up the turbine
- To support the district heating supply

New power plant unit with 660 MWe

- Replaces two power plant units each with 110 MW
- Use of 120 000 m^3 concrete, 22 000 t steel, 20 734 m concrete piles
- Target: minimise emissions, increase efficiency and security of supply, increase power and heat capacities

Power plant Ledvice in the Czech Republic.

The four ZFR-X steam boilers each have an operating weight of 145 tons.

The stringent safety requirements and tight time schedule for implementation of the steam boiler system demanded a high degree of flexibility and experience from all project participants. Rudolf Rotta, sales engineer at the Bosch subsidiary in the Czech Republic: „Following the complex tendering process, our target together with our partner Škoda Praha Invest was to realize the plant as quickly as possible and therefore ensure a consistent supply of heat to the cities of Teplice and Bílina."

After customer-specific manufacturing at the industrial boiler plant in Gunzenhausen (Germany), the steam boilers and components were delivered by special transport by road and waterway to the Czech Republic. The overall transport weight was roughly 480 tons. The boiler house of the power plant comprises a complete steam boiler system, including feed water deaeration system and control technology. As the boilers are more than five metres high, they were equipped with the superheater modules on-site. These are located between the second and third smoke tube passes of the boilers and produce superheated steam. The high steam temperatures avoid energy loss in the pipe network. Due to their considerable size, the feed water deaeration components were also assembled locally. With the deaeration device mounted on top, the plant reaches a height of 13.5 metres and a length of 10.5 metres. It supplies deaerated feed water to the boiler – i.e. free of corrosive elements such as carbon dioxide and oxygen. It can store up to 100 000 litres of feed water. From assembly through to electrical installation, the Bosch team provided on-site support throughout the entire installation period.

Key data of feed water deaeration system:

Deaeration capacity:
177 500 kg/h

Dimensions L x W x H:
10.5 m x 4 m x 13.5 m

Feed water tank content:
100 000 l

Procedure:
Dissolved O_2 und CO_2 are removed from the water to prevent corrosion

Powerful burner output with high efficiency

The four boilers are equipped with eight natural gas burners in total. The total combustion heat output is more than 136 000 kilowatts – equivalent to the output of 250 Formula 1 engines. At this kind of scale, there is a need for high energy efficiency. The burners can be operated particularly economically due to the installed speed controls. They reduce the current consumption in part-load operation by up to 75 percent and also reduce the noise level to a minimum.

Impressive power output: each of the eight burners has a combustion heat performance of 17.1 megawatts.

Thanks to the integrated economizer, more than ten megawatts of waste heat is extracted from the flue gas at full load. This results in fuel savings of up to 10 000 euros per day[1], which is accompanied by a reduction in emission load. The boilers are equipped with combustion control in order to further enhance their efficiency and reduce flue gas losses. It measures the oxygen content in the flue gas and continuously regulates the gas/air mixture within the optimum range. The fuel consumption is reduced by roughly 0.5 to one percent.

[1] assumed gas price 4ct/kWh; operation at nominal load

High degree of efficiency: the economizers utilise flue gas heat to preheat the feed water thus saving large amounts of fuel.

High degree of automation for maximum reliability

Fast availability of the steam boiler is essential for operation of the power plant. Each of the four boilers is therefore equipped with a heat maintenance device by means of a heating coil. This keeps the boiler warm at a reduced pressure. The backup boilers can therefore support the generation of steam within a very short time. Further benefits are the reduced number of start-ups from the cold state, reduced thermal load and longer service life of boiler and burner. The system control ensures smooth operation of the multi-boiler system. The integrated sequence control is realized via a network pressure regulation. As soon as the primary boiler can no longer generate the required steam pressure, the backup boilers switch in automatically. A load-dependent changeover of the primary boiler avoids standstill corrosion.

Control technology

Boiler control BCO

- Visualisation of operating data
- Condition monitoring
- Integrated protection against operating errors
- Automatic activation of desalting and blow-down

System control SCO

- Sequence control
- Activation of deaeration
- Connection to higher-level control system

The higher-level control with industrial Ethernet connection facilitates a direct information flow between the SCO and the control centre of the power plant. All operating signals and current process data are therefore transmitted to the employees at the power plant directly. In case of irregularities they can immediately react. The operating personnel also receive additional support via the boiler controls BCO. The integrated condition monitoring visualizes, for example, water and flue gas contamination or energy losses incurred during desalting via a traffic light model. In addition, the BCO activate the desalting process automatically. If the conductivity of the boiler water exceeds a preset value, the BCO issues a signal to the desalting control valve and boiler water containing salt is discharged accordingly. The advantages compared to a manual operation are reduced energy losses and less demand for fresh water. The situation is similar with the blow-down process, which is also demand-controlled.

In summary, the power plant is equipped with a consistently reliable and energy-efficient steam boiler system. Thanks to the comprehensive automation equipment, high reliability and operation without continuous supervision (BosB 72h) is guaranteed. Vilém Šarkády who works for the general contractor Škoda Praha Invest is very satisfied with the progress of the project:

„Four different boiler manufacturers were in the final selection. The crucial reasons for choosing Bosch were the product quality and brand as well as the reliability.“

The successful project implementation was rounded off with the commissioning of the steam boiler system on time.

The companies involved

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