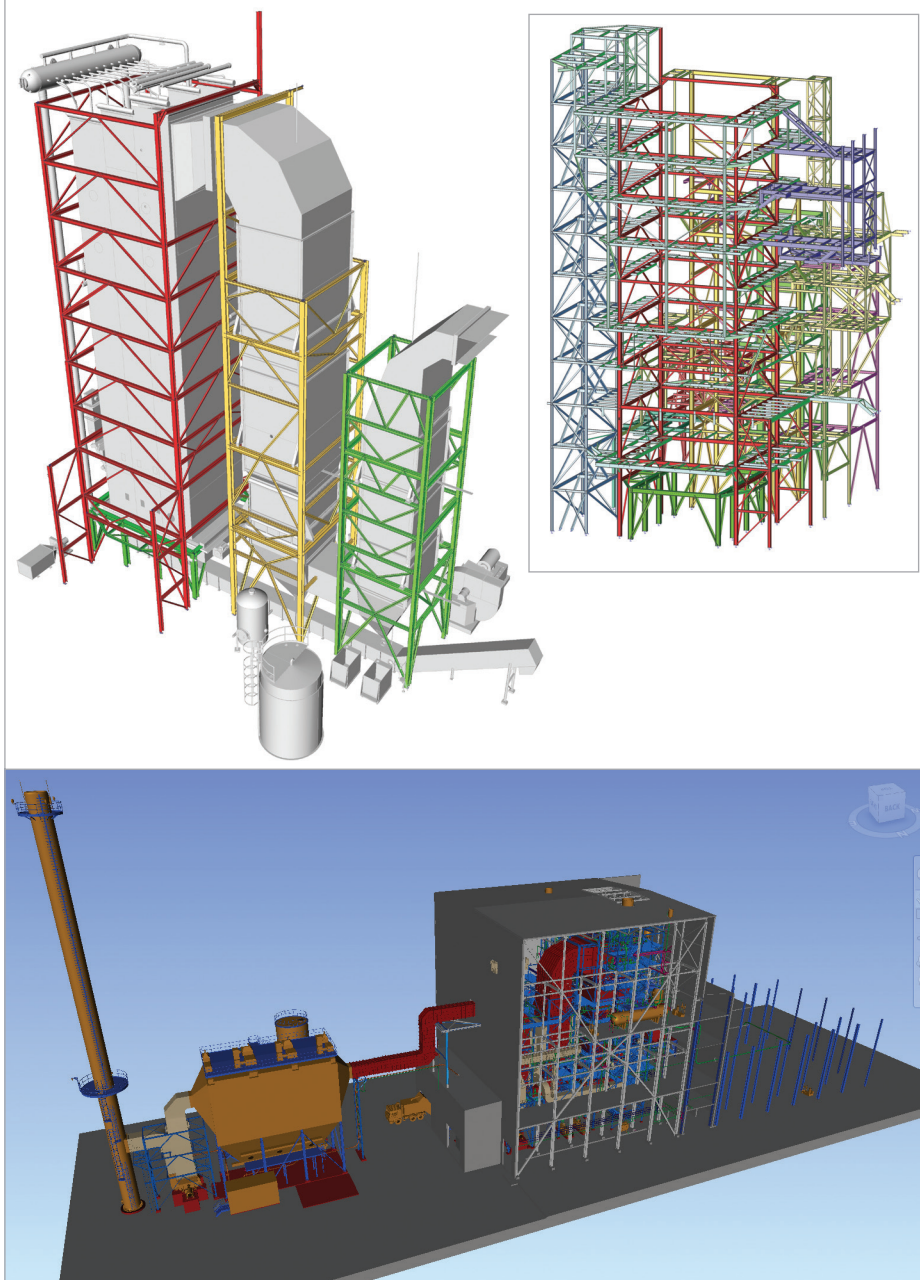


Steel Structure for Biomass Boiler and Service Platforms - Elblag, Poland



General Description of the Structure and Supported Devices

- Overall dimensions of the structure envelope: 21 x 24 x 33 m
- Structure Weight: 215 tonnes
- Number of bars in the structure: 2,254
- Number of joints: 1,254
- Weight of supported technology: 625 tonnes

The presented steel structure serves to secure the operation of the steam three-draught boiler for biomass combustion. The first draught of the boiler is formed by a combustion chamber of the boiler with membrane walls and a membrane top wall, on which there are suspended systems of ribbed tubes. The combustion chamber, with dimensions of 8 x 8 x 25 m and a weight of 295 tonnes, is mounted to slide on a bearing steel structure. Friction bearings along with a guideway in appropriate directions enable the chamber to transform its shape due to considerable heat dilatation. Dilatation movements are enabled from the fixed point on the substructure outwards and upwards in the guideway directions. The bottom of the combustion chamber is formed by a vibration resonance grid, which has been placed on a separate steel concrete structure. The bearing structure of the second and third draught has been designed as a multistage spatial frame. The interconnecting of the structures of the individual draughts has been solved in a way which enables misalignments of the assembly to be compensated. Duct systems supported by this structure are divided into several dilatation units, which are always mounted to slide on the steel structure with the guideway. Another structure serves to support sheet metal ducts and pipelines for water and steam, and to secure the access to technological devices by means of platforms. The whole structure is situated inside the boiler house, to which it is connected on several levels. The method for interconnecting the boiler structure to the boiler house has been chosen so as to hinder the transfer of horizontal forces between individual structures.

Software and Model

The whole structure has been solved as a 3D-framed structure. The greater part of the joints has been modelled as hinged with negligence of the rotary stiffness of the connection. Frame joints have been designed in joints of spar pieces of main structures, where the stability of the structure could not be secured by means of vertical bracing. The influence of the second order has been examined by means of the "Stability" module, with which the maximum critical number of the structure has been determined. As results from the stability assessment, influences of the second order have to be considered. These influences have been implemented into the model in the form of horizontal forces acting to columns within the independent loading cases.

Particular attention has been paid to the structure below the combustion chamber and the structure below the vibration grid. The structure below the chamber was interesting especially in the field of solving details of the chamber's friction bearing. These details have been made without the usage of bearings, with the application of sliding lacquers and appropriate friction coefficients for the determination of horizontal forces.

The structure below the vibration grid was examined dynamically by means of a modal analysis with the development to natural shapes.

Following the execution of the linear static, dynamic and stability analysis, the Scia Engineer program was applied. In this program, we successfully achieved an optimised design structure design. We also managed all the design phases thanks to the application of the transfer of geometry into the Scia program from the AdvanceSteel program by means of the IFC- and XML-Export.

Contact Jiří Protivinský
Address Křížikova 72
61200 Brno, Czech Republic
Phone +420 545 104 059
Email jiri.protivinsky@bbs-cz.bilfinger.com
Website www.babcock-cz.bilfinger.com



Bilfinger Babcock CZ s.r.o. is an important provider of steam generators and power plant equipment. The company provides comprehensive solutions for applications using a wide range of fuels and/or waste heat utilisation, having environmental friendly technologies in focus. In detail, the product portfolio consists of Heat Recovery Steam Generators, Clean Biomass Fired Boilers, Coal Fired Boilers, Special Boilers, Turnkey Plants, Modernization and Repairs of such equipment and newly also 3D Laser Scanning services. The scope of works and services ranges from technical feasibility study up to final assembly, as well as plant operations and lifetime services.

The design of pressure parts and bearing structures of boilers is secured within the company by the Stress Analysis Department managed by Ing. J. Jelinek CSc. This department processes the complete stress design of the pressure pipeline, pressure tanks, flat elements of duct systems and the whole range of dynamic calculations. Steel structures are processed here from the design phases up to the basic design documentation and design of joints.

Project information

Owner	Energa Kogeneracja, Elblag, Poland
Architect	BPIR Protech, Lodz, Poland
General Contractor	Mostostal Warszawa S. A., Warszawa, Poland
Engineering Office	Bilfinger Babcock CZ, Brno, Czech Republic
Location	Elblag, Poland
Construction Period	12/2011 to 03/2013

Short description | **Steel Structure for Biomass Boiler and Service Platforms**

The project subject was the building of the Biomass boiler for combustion of straw and wooden pellets. The device outputs 90 tonnes of steam per hour with the pressure of 95 bar and the temperature of 525°C. The fuel is delivered to the boiler by means of a combination of worm conveyors and pneumatic tossing devices from the daily silo. In individual boiler draughts, the heating of the primary and secondary air, the heating of water and the additional heating of steam takes place. The bearing structure serves as a supporting structure for three boiler draughts, the duct system, and the pipeline for air, water and steam. On the bearing structure, fixed points of the steam piping and the friction bearing of heated boiler parts have been made. At the same time, the structure is used to provide access to individual technological devices. The total weight of the steel structure is 215 tonnes. The total weight of the supported technology is 625 tonnes.

