SECTION 1. ARCHITECTURE AND CONSTRUCTION

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1.1 Reconstruction of the industrial building under the boiler house

In recent years and in the near future, the main directions of structural reorganization of industrial construction are the expansion and reconstruction of existing industrial facilities [1, 2, 3]. Also, in connection with the modern trend of technical re-equipment of industrial enterprises, there is a need to reconstruct the buildings and structures in which they are located. Reconstruction involves rebuilding a building with the aim of partially or completely changing its functional purpose. Reconstruction of existing buildings is associated with improvement of production, improvement of operating conditions, change of basic technical and economic indicators, etc., which is accompanied by strengthening of structural elements of these buildings.

This study examines one of these buildings - an industrial building located on the territory of the former house-building plant #2 in the village of Murovane of the Lviv region. The building under investigation is attached to the existing building of warehouses and is located in a complex that is to be reconstructed into a logistics center (Fig. 1). The new functional purpose of the investigated building is a boiler house.

According to the structural scheme, the investigated building belongs to buildings with a mixed frame with hanging wall panels (Fig. 2, 3). The main step of the columns along the axis "G" is 6.0 m. Along the axis "D/1" between the axes "17/1-20" the step of the columns is 6.0+3.0 m, between the axes "13-17/1 " - a brick wall with a thickness of 380 mm with pilasters located at a step of 6.0 m. The span of the building is 18.0 m. The building is one-story with dimensions in the axes of 38.52×18.0 m. The height to the bottom of the covering slabs is 4.46 m.

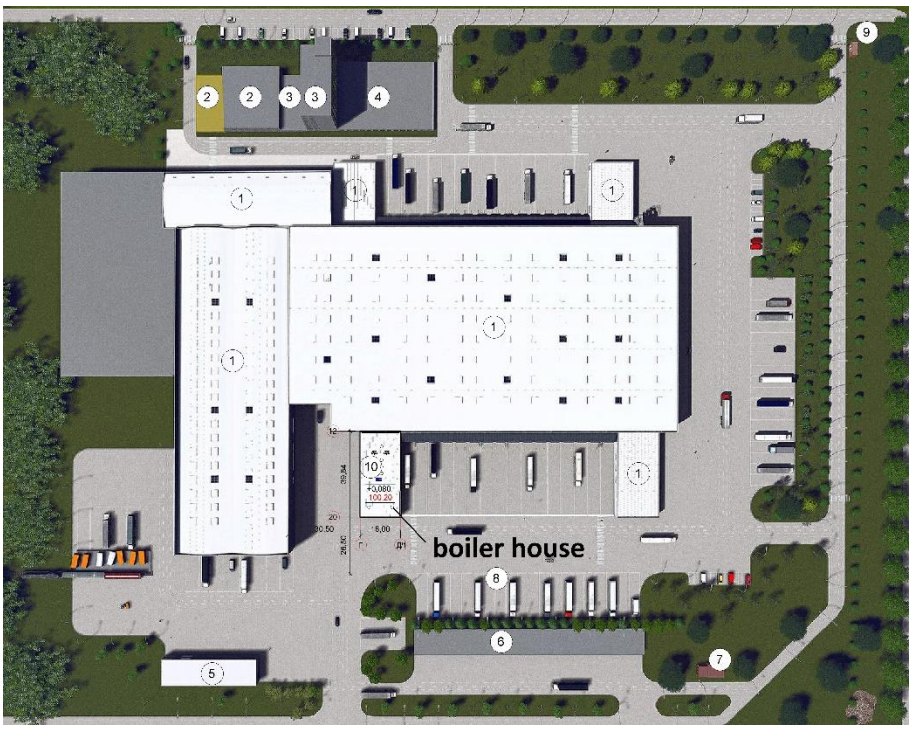


Figure 1. Scheme of the master plan of the logistics center

Figure 2. View of the facades of the existing building

Figure 3. View of the existing building from the inside

The existing columns in axes "13-20" along axis "G" are solid reinforced concrete, with a section of 300×400 mm. The columns in the axes "17/1-20" along the axis "D/1" are solid reinforced concrete, with a section of 400×400 mm. In the axes "13-17/1" along the axis "D/1" instead of columns, there is a brick wall with pilasters, which are made with a step of 6.0 m. Reinforced concrete beams with a section of 250×600 mm rest on the columns and pilasters. In the axes "19-20" along the "G" axis and "17-17/1", "18/1-20" along the "D/1" axis, metal beams 60B1 are installed instead of reinforced concrete beams. Pre-tensioned 1ПГ18-2АуТ slabs, 3.0×18.0 m in plan size, were used as a covering. The external walls are made of hinged expanded clay concrete wall panels with a thickness of 240 mm.

In order to make a decision on the possibility of reconstruction, a technical inspection of the building was carried out in accordance with regulatory requirements [4]. Reconstruction according to the new functional purpose [5] involves the re-planning of the premises using new equipment, the installation of new equipment with the arrangement of foundations for it, the arrangement of floors, the replacement of windows and doors, the insulation of external walls (Figs. 4, 5, 6).

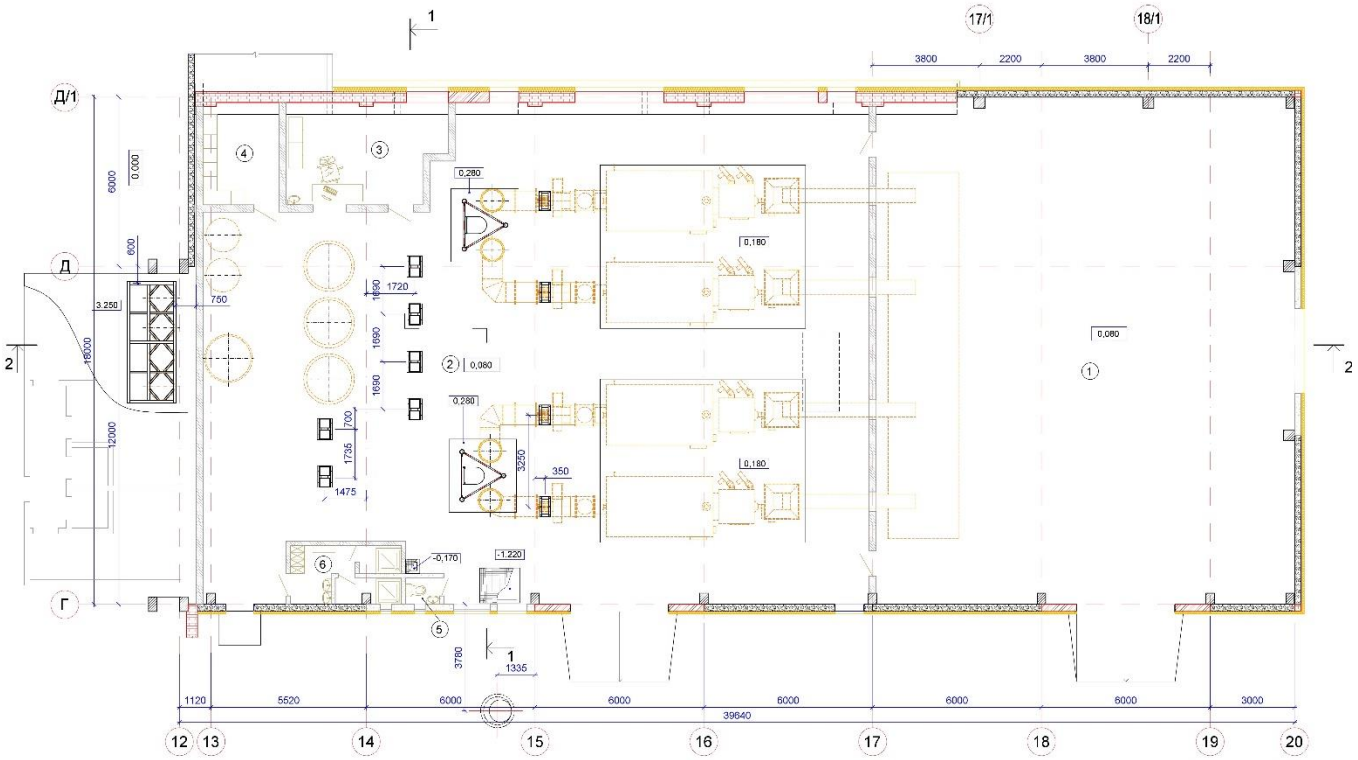


Figure 4. Plan of the boiler house after reconstruction

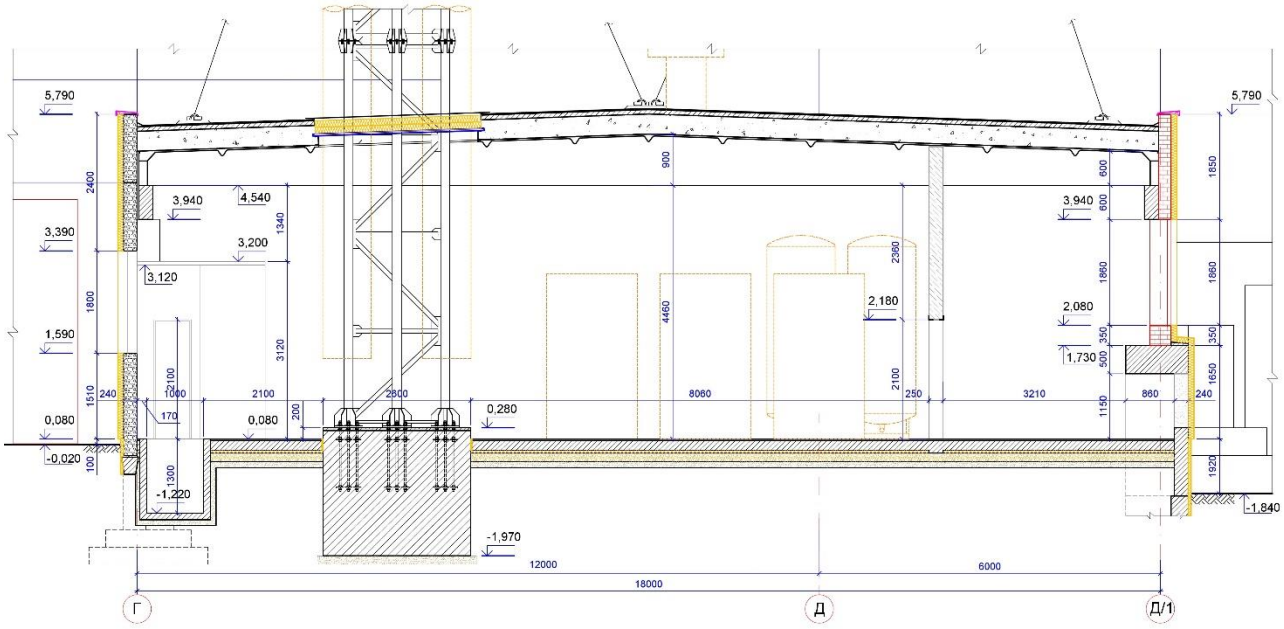


Figure 5. Cross-section of the building after reconstruction "1-1"

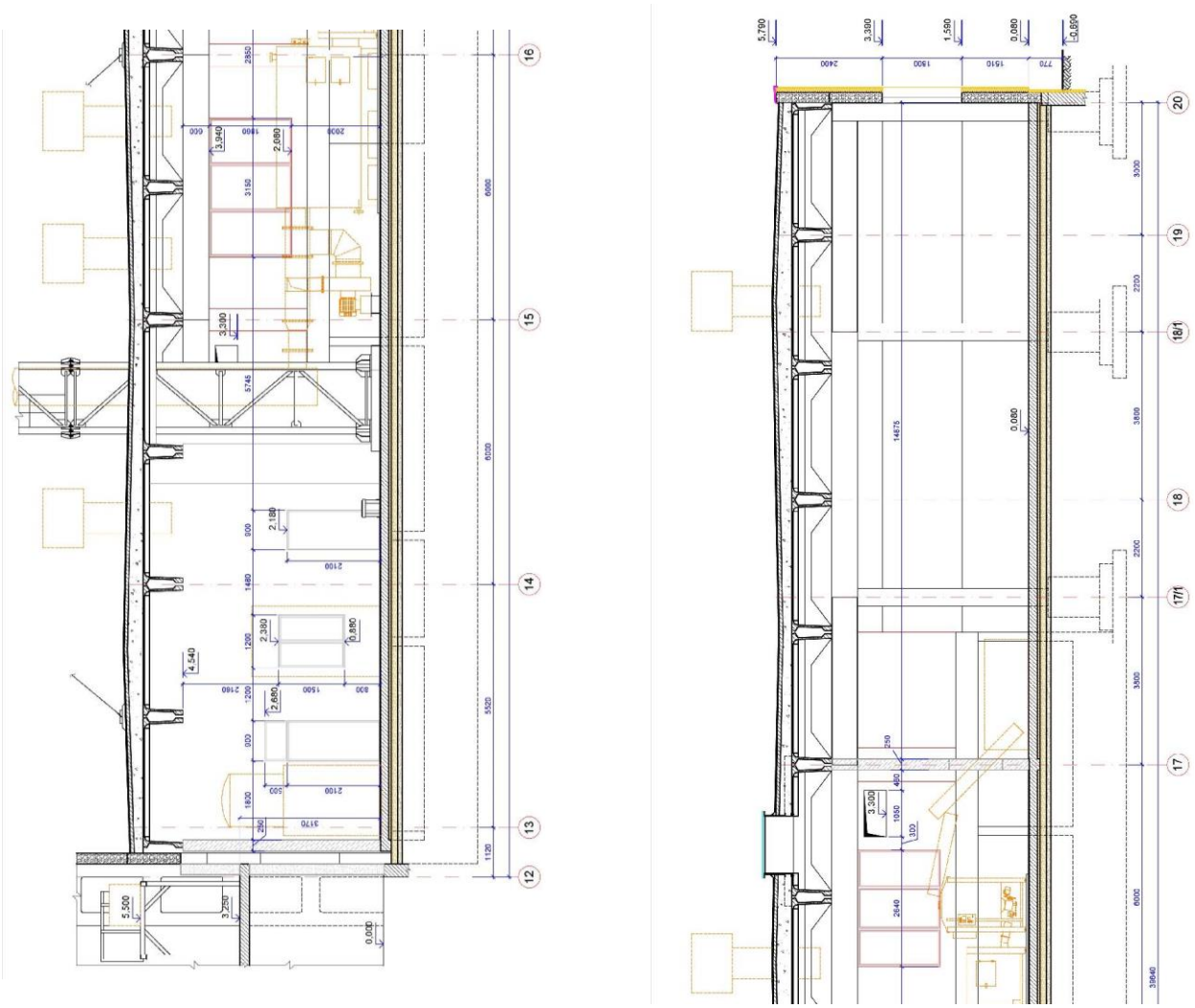


Figure 6. Longitudinal section of the building after reconstruction "2-2"

In the process of re-planning, the following rooms are provided: boiler room, wood chip warehouse, operator's boiler room, technical room of the boiler room, a bathroom and a shower room with a changing room.

The reconstruction envisages the installation of four solid fuel boilers with a capacity of 1.5 MW each. For them, two slab reinforced concrete foundations have been designed, the size of which is 5800×7300 mm and the thickness is 500 mm.

To remove combustion products from the boilers, four (one per boiler) insulated smoke pipes with an outer diameter of D=800 mm and a height of H=21.0 m are provided. It was decided to use a truss type of pipe arrangement. For this purpose, two three-dimensional spatial lattice towers (Fig. 7) were designed, which rest on designed columnar foundations, with a plan size of 2400×2600 mm and a height of 2200 mm (taking into account the large layer of loose soil). One lattice tower is provided for two smoke pipes.

Taking into account the manufacturing, transportation and installation technology, the tower is designed from three sections, each 6800 mm high, which are connected to each other with high-strength bolts (Fig. 8). The tower belts are made of seamless pipe ∅159×8 for the lower section, ∅159×6 for the middle and upper sections. The braces are made of closed welded rectangular (80×60×5) and square (50×50×5) profiles. In the middle and upper sections, service ladders are provided, which are placed inside the triangular tower. The spatial lattice tower is connected to the designed foundation using anchor bolts ∅30 mm (Fig. 10, 11). To reduce the horizontal movements of the towers, rope tensioners are designed (three tensioners per tower), which are fixed to the ribs of the covering slabs (Fig. 9).

For the passage of smoke pipes and spatial lattice towers, holes of 1.85×2.8 m are made in the covering plates. Also, a 1.3×2.8 m hole was made in one slab for the installation of an anti-aircraft smoke removal lantern. These holes are reinforced with metal frames, which are located on top of the covering plates and rest on their edges (Fig. 12).

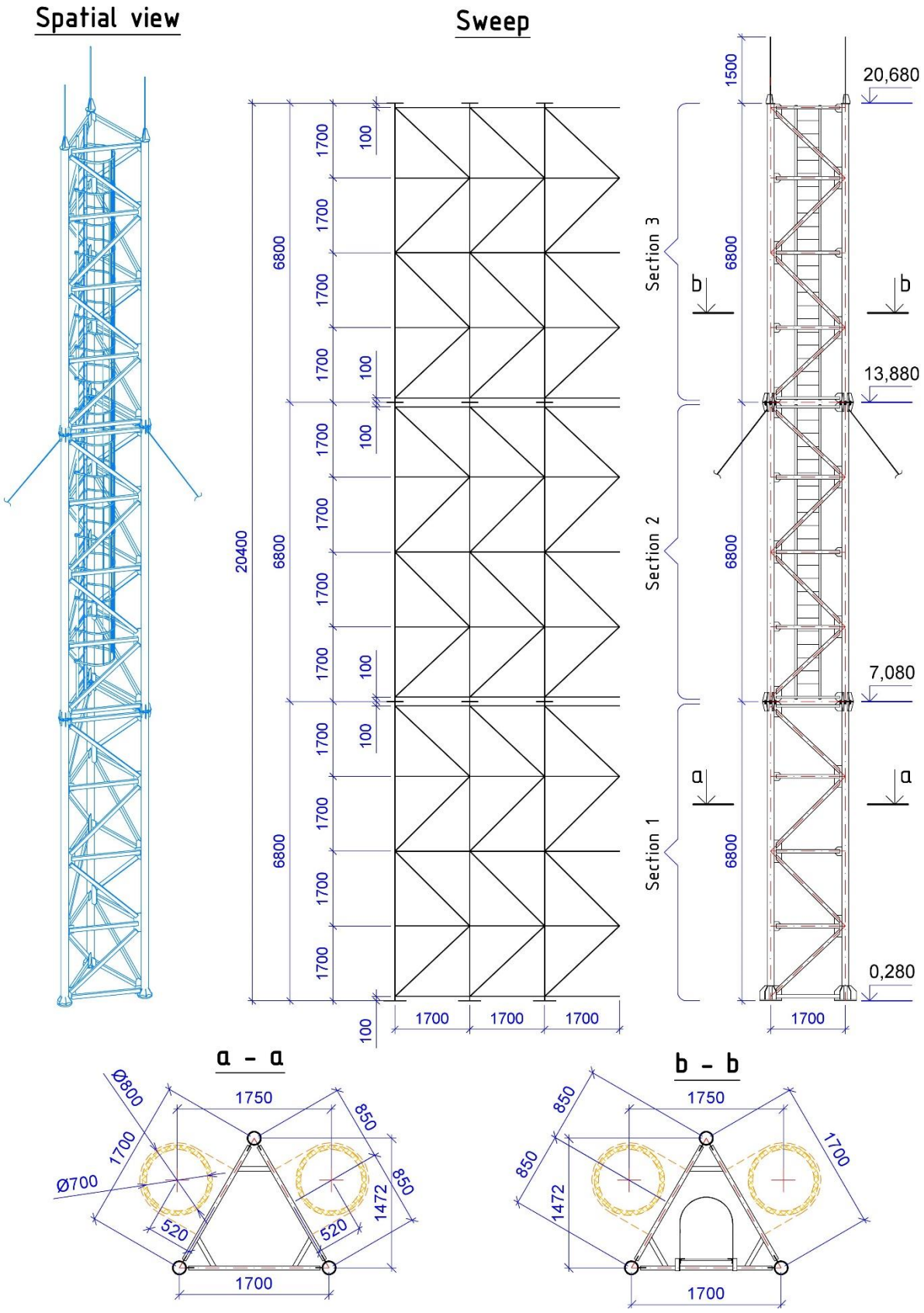


Figure 7. Spatial lattice tower for pipes

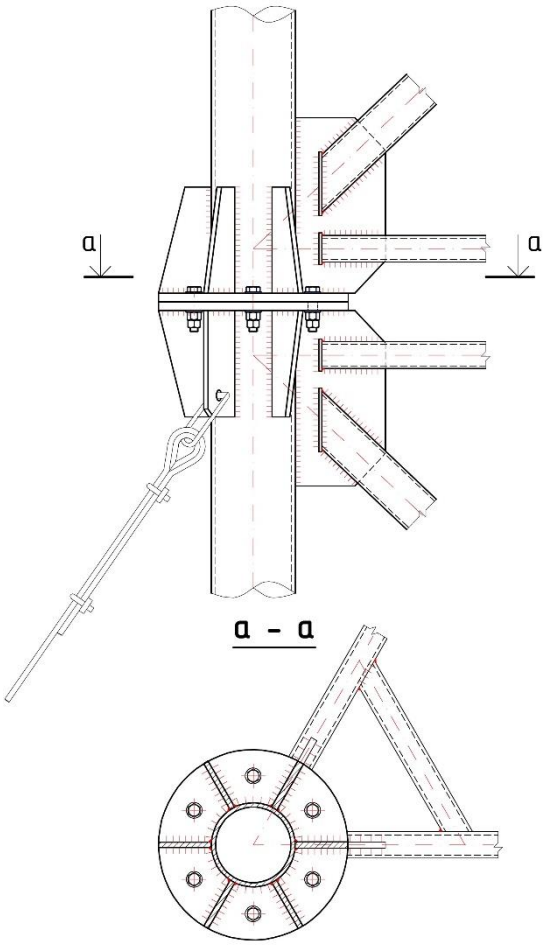


Figure 8. The node of the combination of sections of the lattice tower

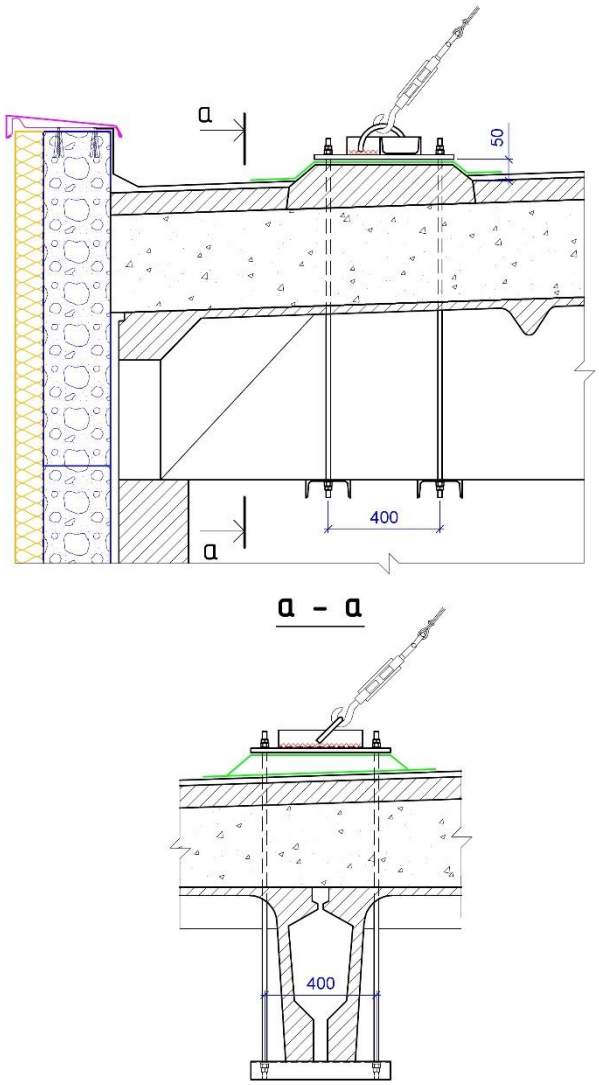
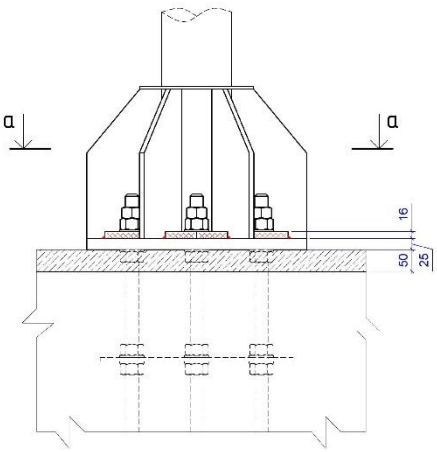


Figure 9. The unit for fastening the braces to the covering plates



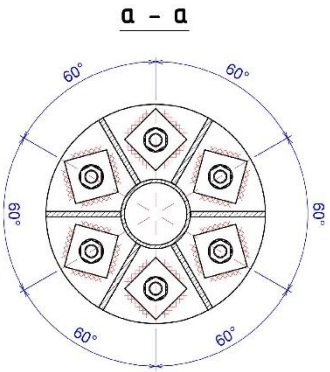


Figure 10. The junction of the tower section to the foundation

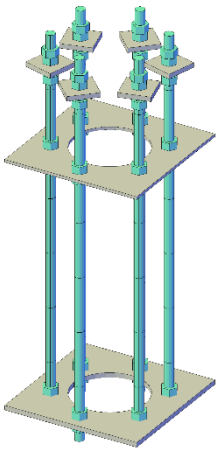


Figure 11. Block of anchor bolts

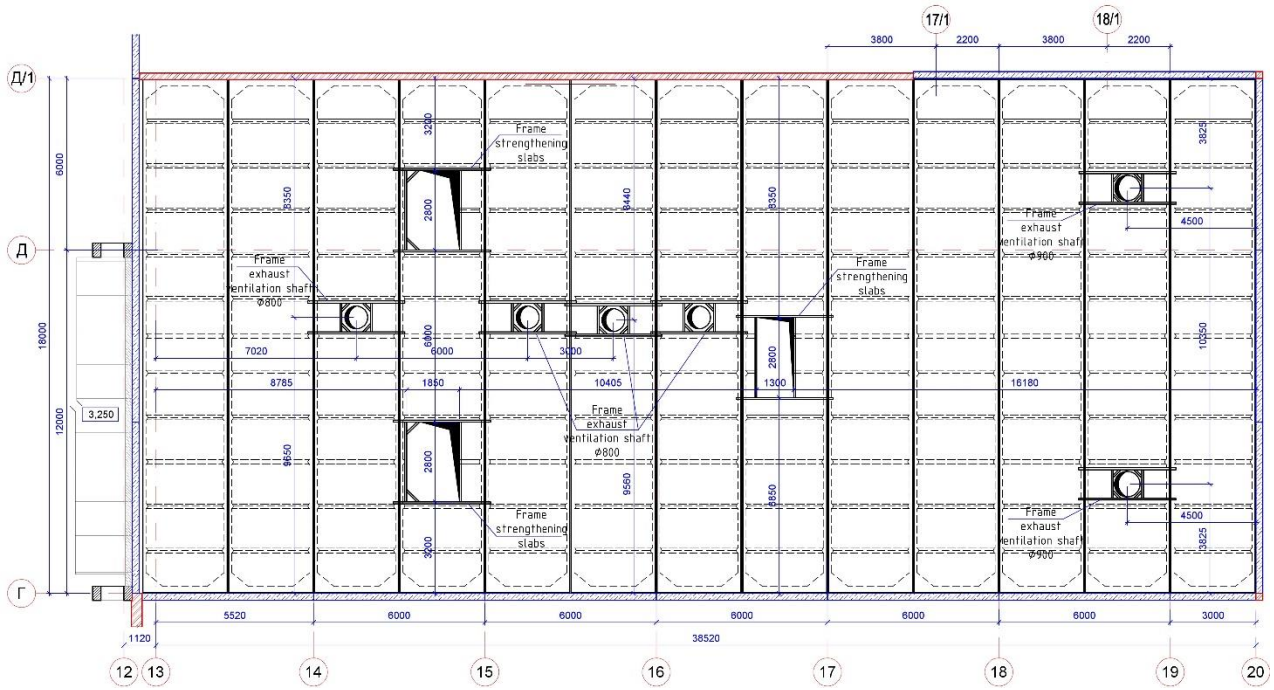


Figure 12. Scheme of the location of holes in the covering plates and their reinforcement elements

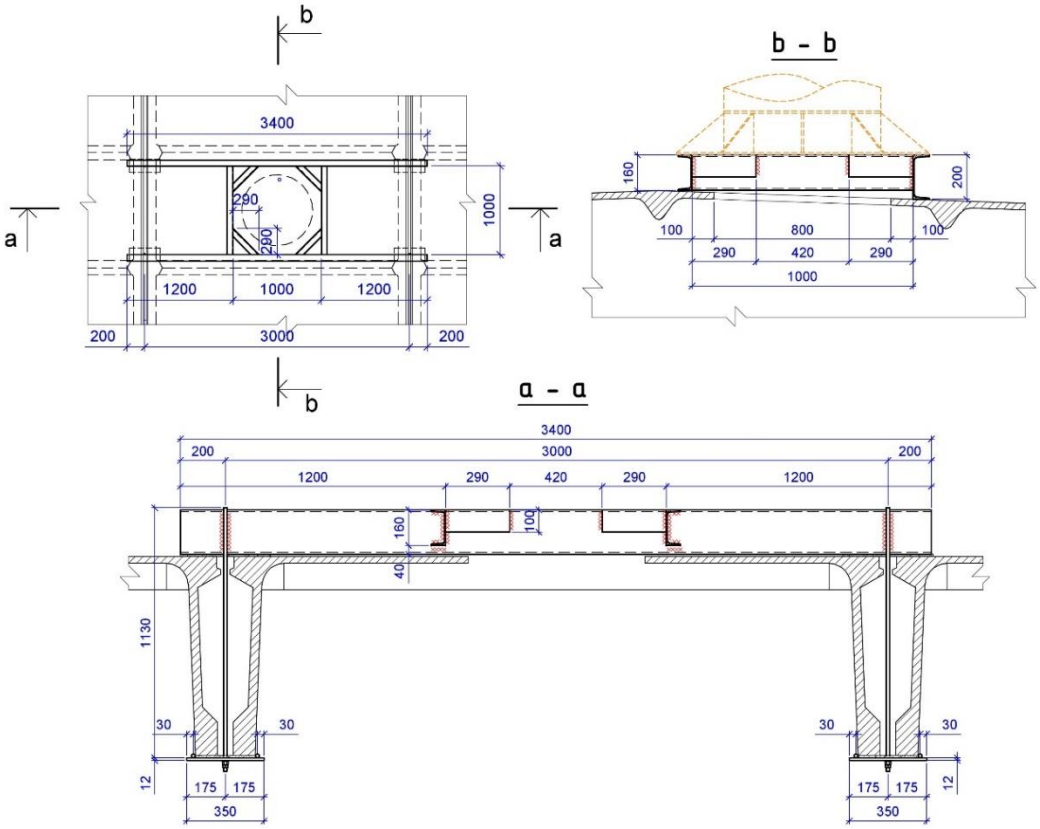


Figure 13. Frame for supporting ventilation shafts

For the passage of exhaust ventilation shafts, holes of ∅800 mm and ∅900 mm are made in the covering plates (between the transverse ribs). Additional frames are designed to support the exhaust shafts, which are located on top of the covering plates and rest and are fixed on their ribs (Fig. 12, 13).

Also, within the framework of the reconstruction, a full range of works, provided for such buildings, was performed. The proposed and implemented version of the reconstruction of the industrial building (Fig. 14) met all the requirements and can be used in the reconstruction of similar buildings.