
Set of device to shell build-up of natural draft cooling towers

SZ-1

Introduction

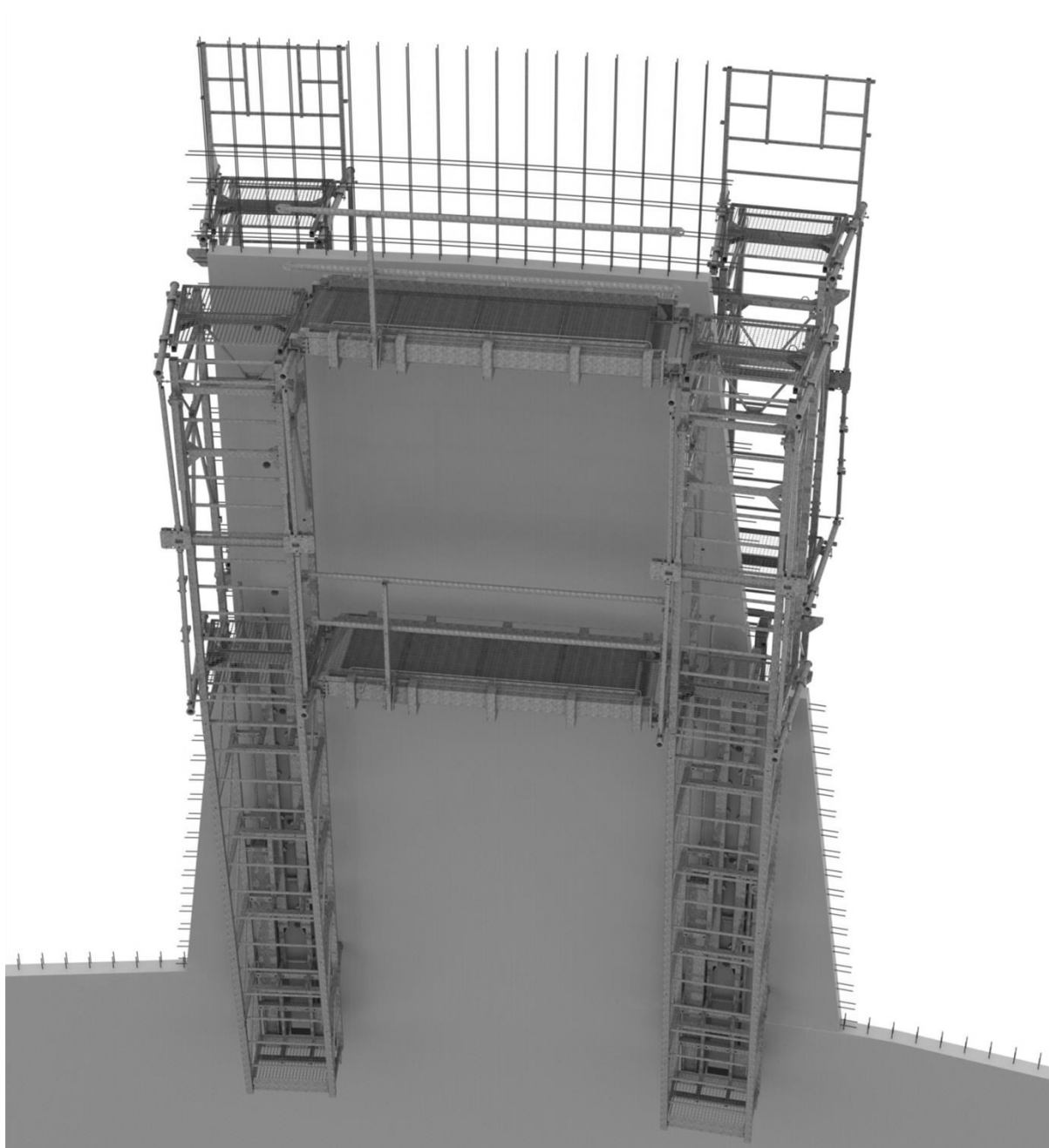


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Symbols

The following symbols used within this document:



Information

Information for those reading the document.



Tip

Refers to useful advice and tips.



Reference

Refers to other documents.

Product description – requirements concerning use

Set of device for shell buildup of natural draught cooling towers by the company Chladicí věže Praha, a.s.

The system is to be used to shell buildup of natural draft cooling towers: hyperbolic, parabolic or linear shells in shape. The set of device (hereinafter referred to as SZ) is mechanic-climbing equipment with an electromechanical drive. Owing to the system, the work is being done quickly and the final construction has a high degree of accuracy.

Concrete aprons

The final concrete aprons have a high quality level and long life due to the formwork system. The shell reinforced concrete structure is being erected gradually by individual strips (straps).

- Concrete straps are 1.4 m high.
- Formwork elements have min. width of 0.6 m and every element is inclined in relation to the other ones at a certain angle. Owing to this, the required round shape is achieved.
- SZ does not make use of any permanent anchorage and therefore the final construction has a long life.
- Reinforcement may be covered with concrete of 1 to 5 cm, depending on jacket project requirements.
- Wall thickness must not be less than 15 cm.

Accuracy

Accuracy is of key importance as regards the work being done in connection with the cooling towers, especially as regards statics and functioning.

- Formwork system ensures the wall thickness and its final position with accuracy that is in accordance with standard EN 13 670.
- Longitudinal change of length is balanced with limiting elements.
- Vertical change of the strap inclination is balanced by means of vertical strap anchors.
- The formwork system is self-supporting and anchored to the previous straps – this ensures maximum accuracy and stability.
- With the set of equipment it is possible to form such jackets whose curve changes its inclination within every strap by as many as 0.5°
- The system is set out by surveyors owing to which maximum accuracy is ensured. Corrections may take place prior to concrete laying as well as after the concrete laying is finished.

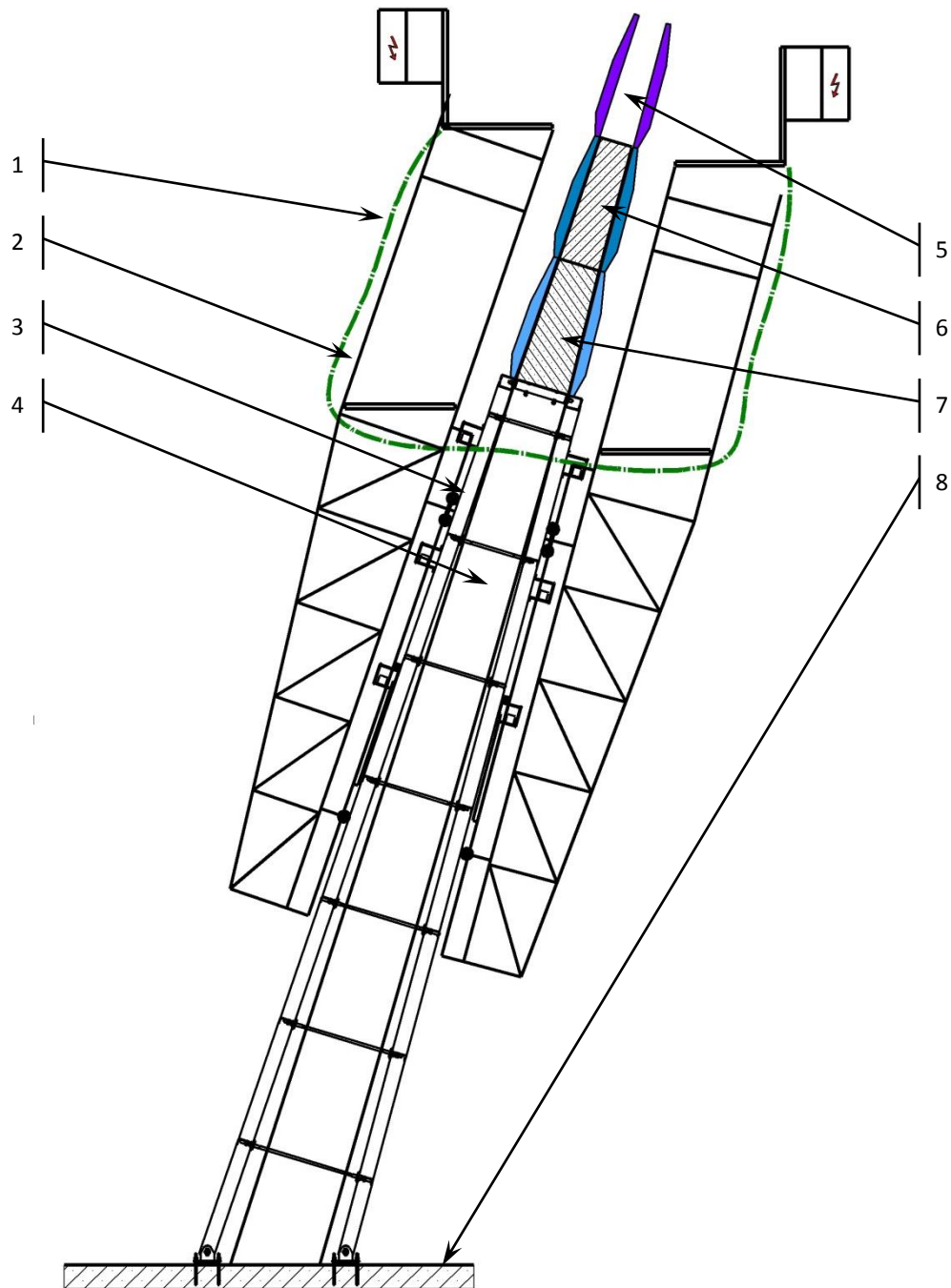
Safety

- In the course of the entire process of climbing the set of device (SZ) is guided safely and may be quickly moved at great heights even when weather conditions are not favorable.
- The SZ pylon which is a load-carrying and also a lifting element is ensured min. by two anchor bolts whose dimensions are chosen so that no accident can occur, not even under extra conditions which may occur at any construction site even if high-level safety standards are being observed. This ensures the highest safety level.
- Telescopic working platforms are enclosed and safe places of work on all working and climbing levels.
- Along with its additional accessories the set of device (SZ) can be used all year round, incl. work at low temperatures and under unfavorable weather conditions.

Handling

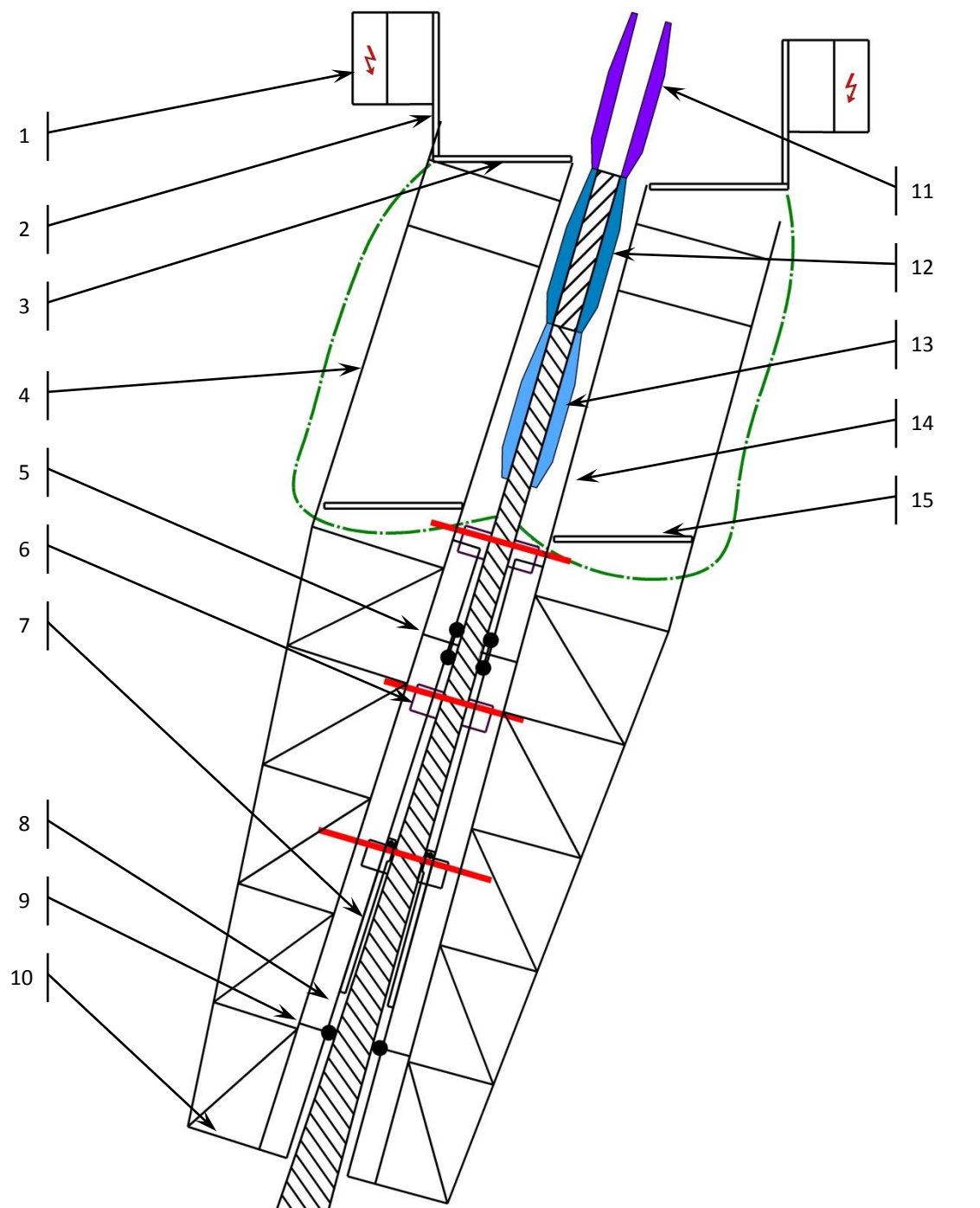
- Formwork elements are handled manually. They may be moved manually or by means of suitable machinery e.
- Formwork is removed manually.
- The set of device (SZ) is lifted primarily by means of an electromechanical drive. In case of extra circumstances it is possible to lift the equipment by means of a crane or manually.
- Inclination of working platforms is set by means of central mechanisms simultaneously for all height levels.

System parts at the beginning of shell build-up



- 1) Safety net
- 2) Set of device pylon
- 3) Universal/standard runway
- 4) Tower column
- 5) Concrete strap
- 6) Second strap
- 7) First strap (lead wing)
- 8) Tower foundation strip

System parts in process of shell build-up



- | | |
|---------------------------------------|---|
| 1) Switchboard | 9) Lower undercarriage |
| 2) Safety fence of the upper platform | 10) Pylon lower bottom plate |
| 3) Upper platform | 11) Concrete strap (1 st formwork layer) |
| 4) Set of device pylon | 12) Second formwork layer |
| 5) Upper undercarriage | 13) Third formwork layer |
| 6) Guide block, anchor bolt and nut | 14) Space for the drive |
| 7) Carriage | 15) Lower platform |
| 8) Drive | |

Work cycle

Speed of the work cycle depends on the following factors:

- Cooling tower diameter
- Number of workers
- Experience of workers
- Infrastructure of the construction site and conveying capacity of means transporting material

In general, it is possible to take into account the speed of 1-3 days per 1 cycle (1 strap). Depending on the diameter and height of the cooling tower. Qualified estimate of the speed will be provided by the manufacturer of the set of device during the phase of projecting.

Work cycle (starts after placement of concrete):

- Removal of vertical strap anchors of the second and third formwork layers and their installation on the first formwork layer
- Binding the reinforcement
- Removal of the third formwork layer
- Concrete curing after the formwork layer has been removed
- Installing the inner part of formwork
- Installing the outer part of formwork (so called closing up)
- Formwork aiming
- Lifting the set of device
- Placement of concrete



All the steps of a cycle may either take place separately, that means as soon as one step is finished, another step is taking place. Steps may also take place on a spiral, that means as soon as one step is finished within a section, it is possible to take another step. In this way it is possible to take all steps at the same time within the entire set of equipment, however, it is necessary to follow the specified work order. This work cycle ensures that there are no additional construction joints.



If necessary, it is possible to remove the second formwork layer after the formwork is aimed.

Additional information

Transport of persons

- Transport of persons within the set of device is provided by a passenger lift.
- Persons move from the lift to the set of equipment by means of a transfer module.
- The transfer module is situated on a transfer pylon and is used as a main junction allowing persons to enter the lower platform of the set of device (SZ).
- The module is used to balance the change of the position of the lift guide pylon and the pylon of the set of device (SZ). It balances longitudinal changes of position and vertical inclinations from the ideal position.

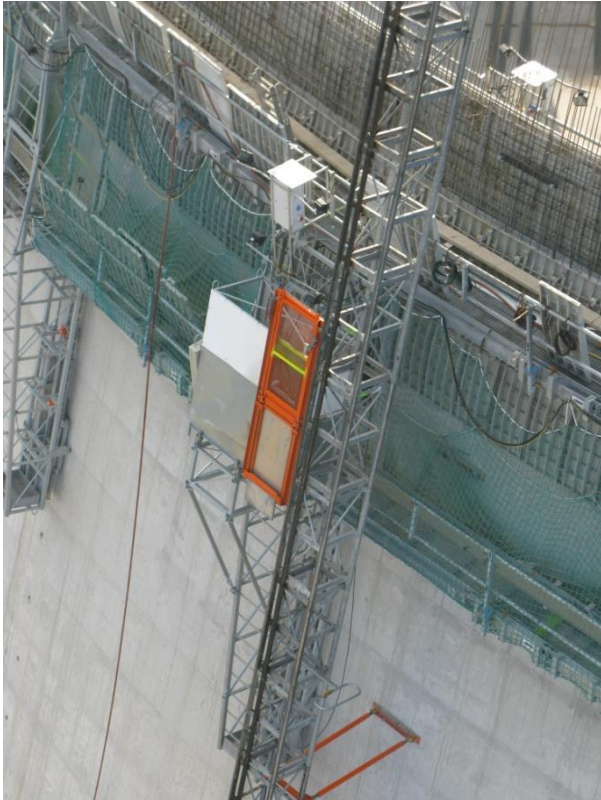


Figure 1 – transfer module on the outer ring



Figure 2 - Passenger lift transporting persons

Crossings



In case the work cycle is based on a slower speed, that means that work is always commenced after the previous step is finished (see Chapter: Work cycle), it is advisable that workers use a platform to move between the inner and outer rings; the platform is part of accessories.

Electricity

- Every pylon of the set of device may be equipped with one switchboard.
- Depending on the goals of the user it is possible to choose from among a standard switchboard, switchboard with el. heating, and a main supply switchboard.
- Switchboards may be equipped, depending on what is required by the user, with halogen lighting, separately for the upper platform and separately for the lower platform.
- On the basis of a requirement it is possible to provide the switchboards with drawers for documents (protection against weather conditions), the switchboards may be provided with first aid kits.
- El. cables, air ducts and water pipes may be attached to the set of device by being suspended on hooks of telescopic platforms. No cables, ducts or pipes will prevent people from free movement within the set of device (SZ).

Weather conditions

- Work within the set of device may be performed up to the wind speed of 12.5 m/s.
- Work must be stopped at higher speeds of wind. Before leaving the place of work it is necessary to attach any free formwork boards to prevent them from moving.
- Work within the set of equipment may be carried out if the visibility is more than 20 m.
- If the set of equipment is provided with lighting allowing work at night, it is possible to carry out all work at night time and when the visibility is lower.
- Rain and drizzle do not prevent work within the set of device (SZ). All floors are provided with antiskid walking grates.
- If the set of device is provided with el. heating, it is possible to carry out building work incl. placement of concrete at temperatures below 0°C.

Use of safety nets

- For the purposes of increasing safety it is possible to use safety nets within the set of device. These trap both persons and material.
- The nets may be completed with a fine mesh that will trap also small impurities and dirt, grain size min. 2 mm. Users will thus considerably reduce the falling of normal debris on the ground under the set of device (SZ).

Other documents



Service organization also provides other documents such as project documents, instructions for use, manuals, etc.

Set of device in use



Figure 3 – Construction site facilities



Figure 4 – Founding the tower columns



Figure 5 – Placing concrete for the tower columns



Figure 6 – Placing the first strap



Figure 7 – First strap formwork (lead wing)



Figure 8 – First strap formwork



Figure 9 – Concreting the first strap (lead wing)



Figure 10 – Concreting the first strap - detail



Figure 11 – Removing the first strap support



Figure 12 – First strap after the removal of support



Figure 13 – Lead wing ready to attach set of device



Figure 14 – Set of device being attached



Figure 15 – Part of the set of device before attaching



Figure 16 – Tower inlet channel

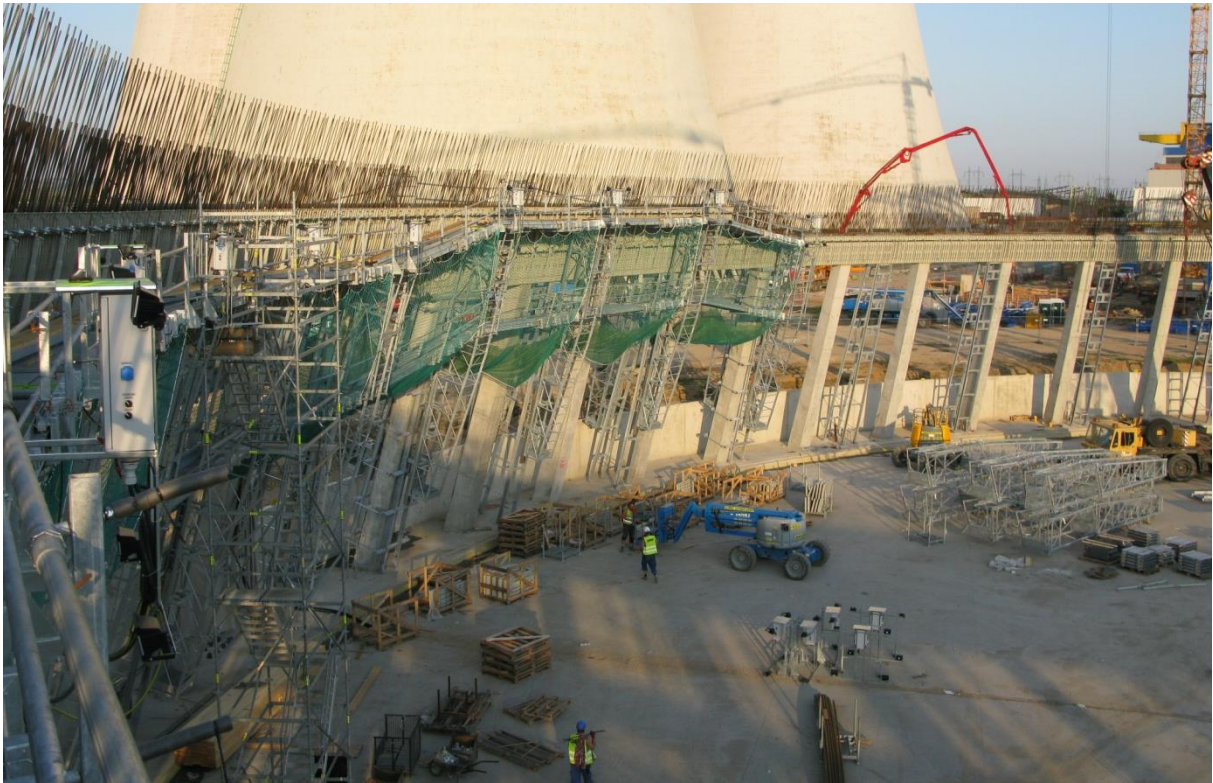


Figure 17 – Set of device starts to buildup shell immediately after attachment



Figure 18 – Set of device after the installation is finished



Figure 19 – Building the climbing channel

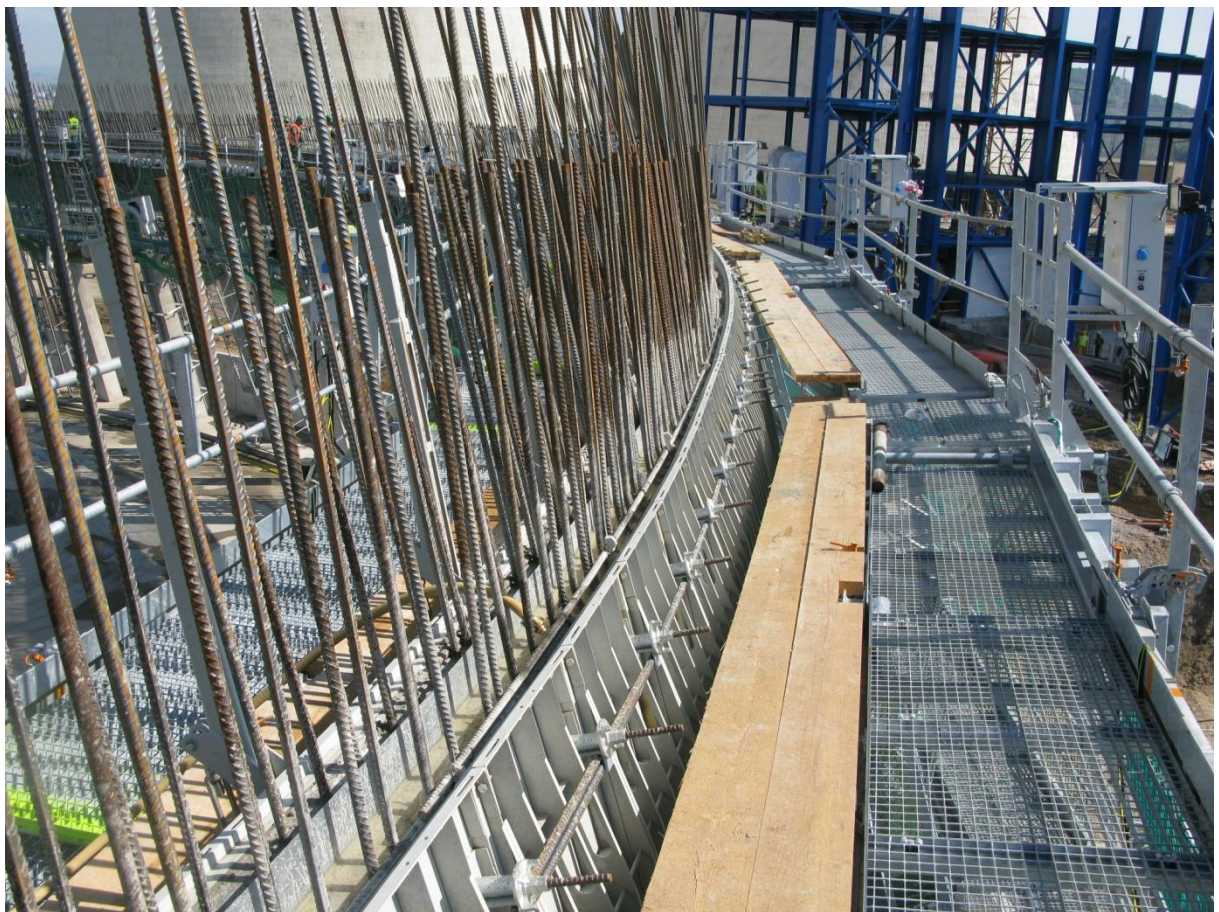


Figure 20 – Work area within the set of device



Figure 21 – The process results in very clean concrete aprons



Figure 22 – Building the chamber to house the closing flap on the inlet channel



Figure 23 – Set of device prior to the concreting of the seventh strap



Figure 24 – Set of device during a night shift – outer ring

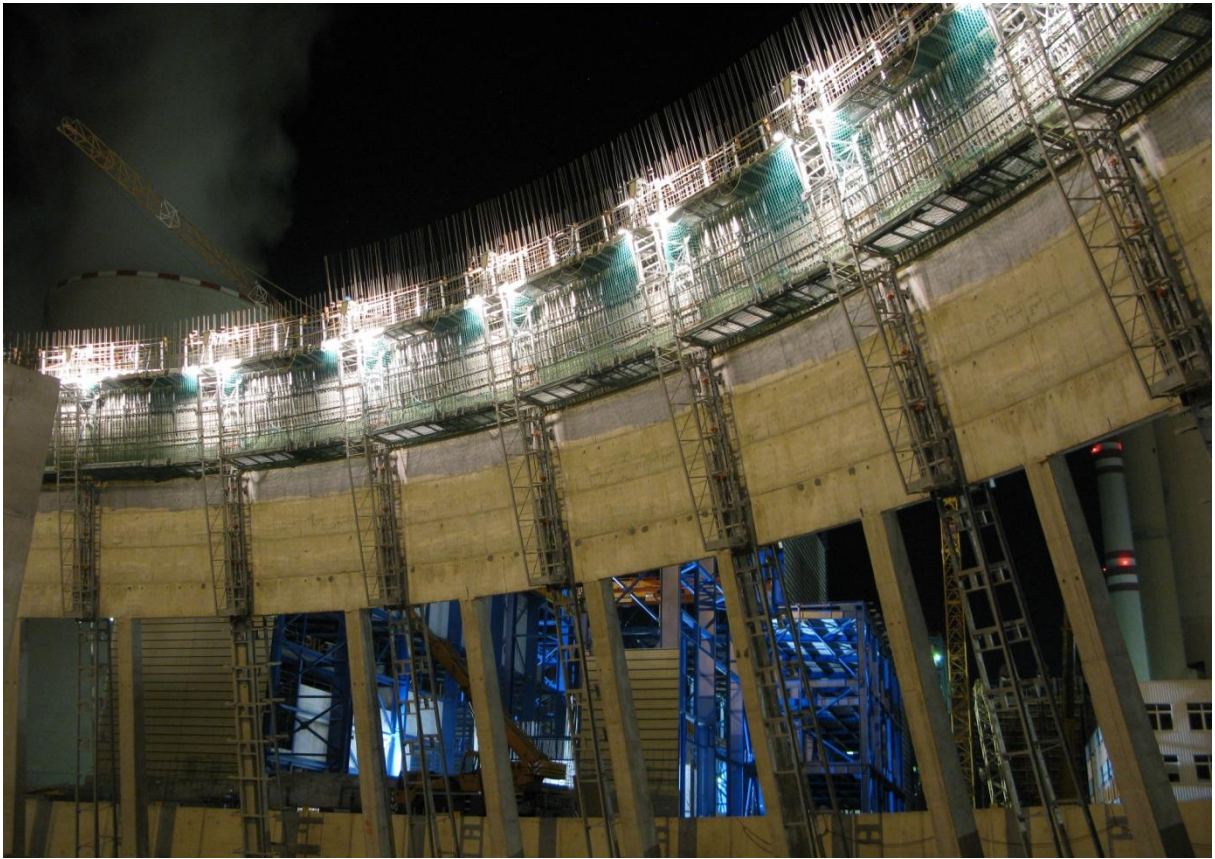


Figure 25 – Set of device during a night shift – inner ring



Figure 26 – Set of device during the concreting of the 15th strap – formwork is getting in place



Figure 27 – Covering the inlet pipes



Figure 28 – Outlet channel and inlet pipes orientation

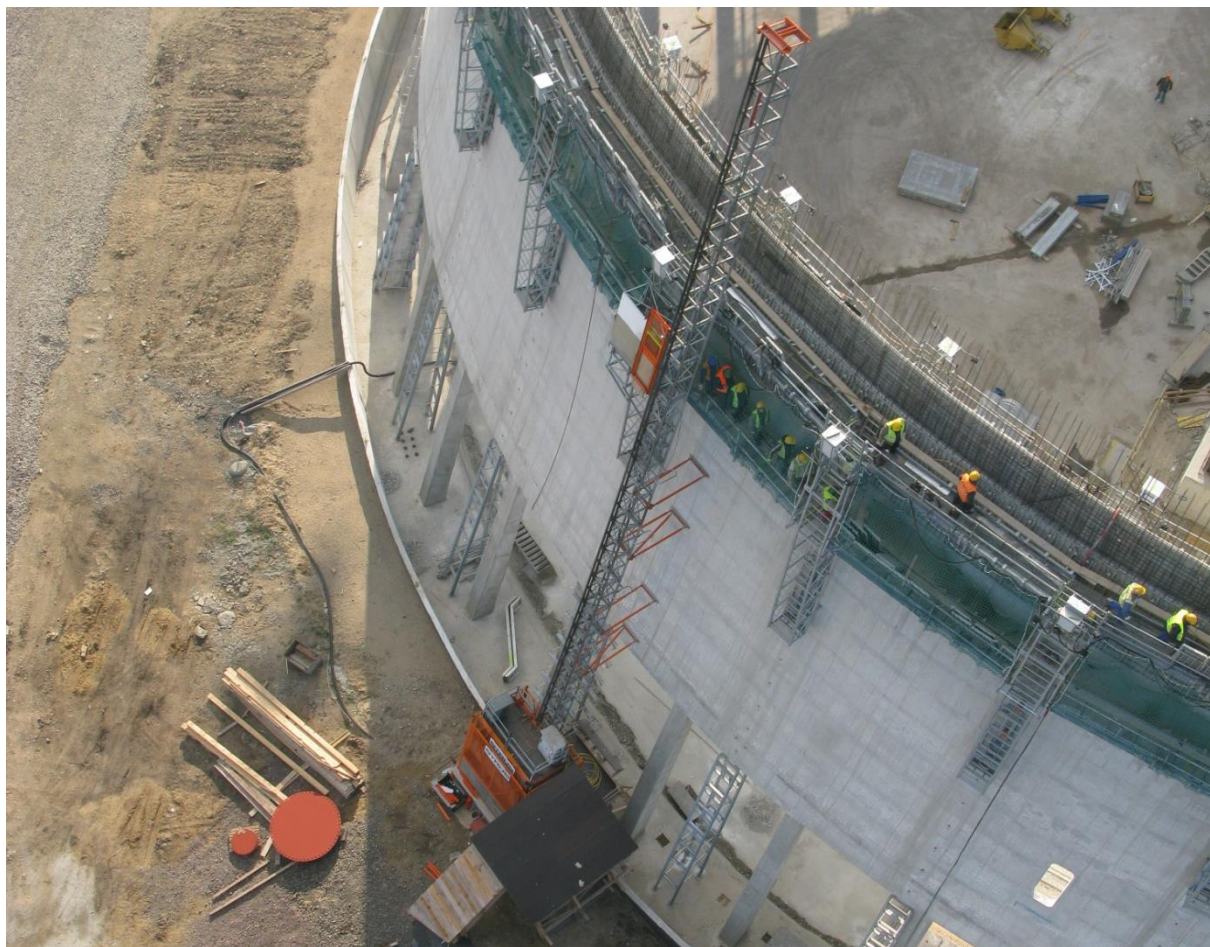


Figure 29 – Way of transporting persons to the set of device



Figure 30 – Passenger lift on the level of the set of device



Figure 31 – The contract also comprises the installation of pumping circuits



Figure 32 – Set of device together with formwork system and installed safety nets



Figure 33 – Set of device and winter arrangements



Figure 34 – Set of device – view of the passenger lift and temporary entrance into the tower



Figure 35 – View of completing work on the pumping station and the outlet channel of the tower

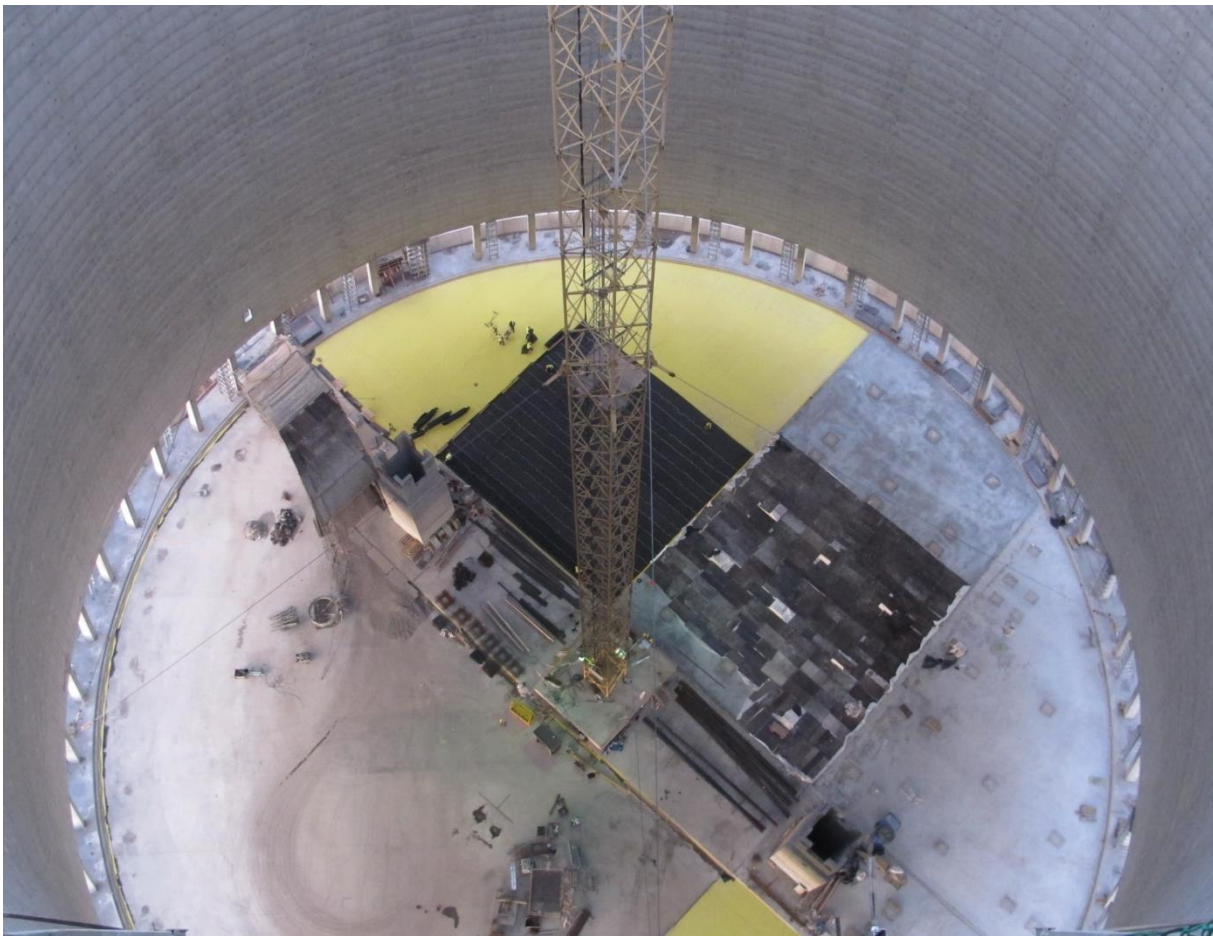


Figure 36 – Building the foundation plate and prefabricated building-in while the tower shell is being build-up. First, insulation is being laid, then reinforcement is put in place and finally the plate is filled with concrete

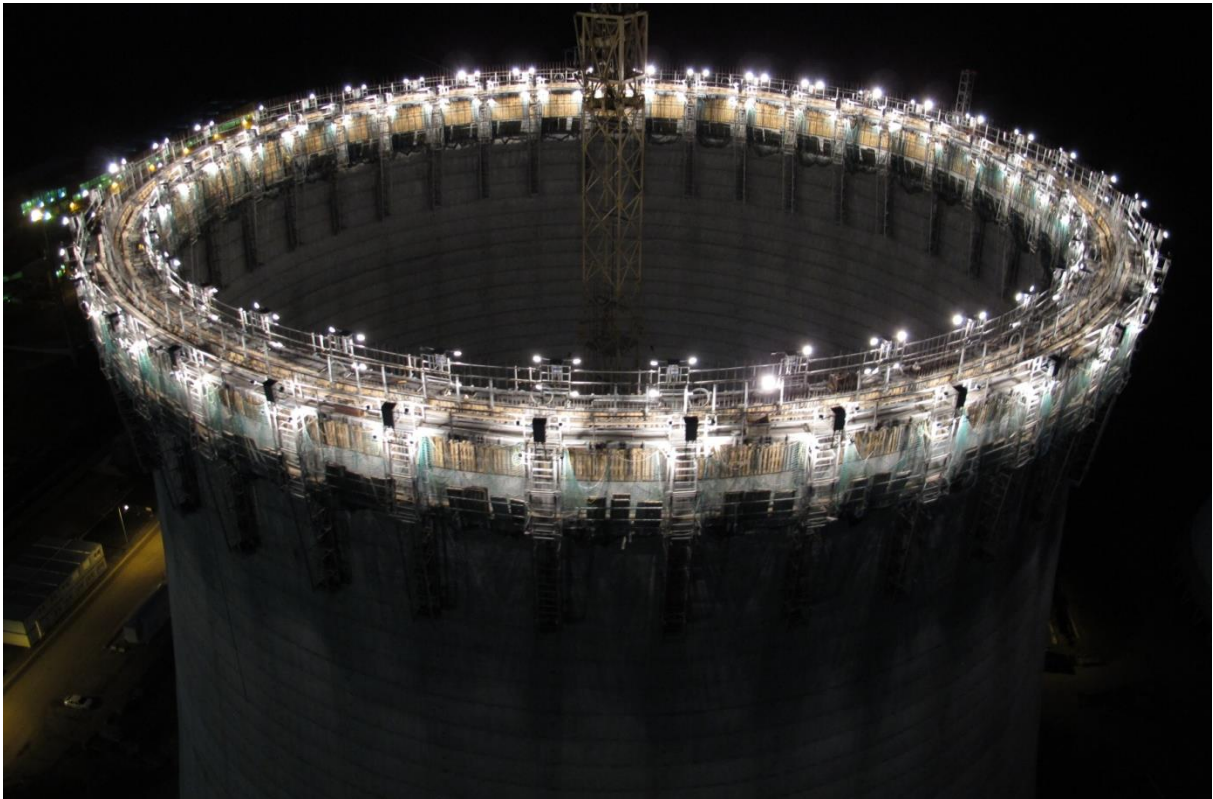


Figure 37 – Set of device when working at night



Figure 38 – View of the set of device and the construction site at night



Figure 39 – Set of device while the construction work is being done.



Figure 40 – Completed cooling tower

Manufacturer, service organization

Manufacturer

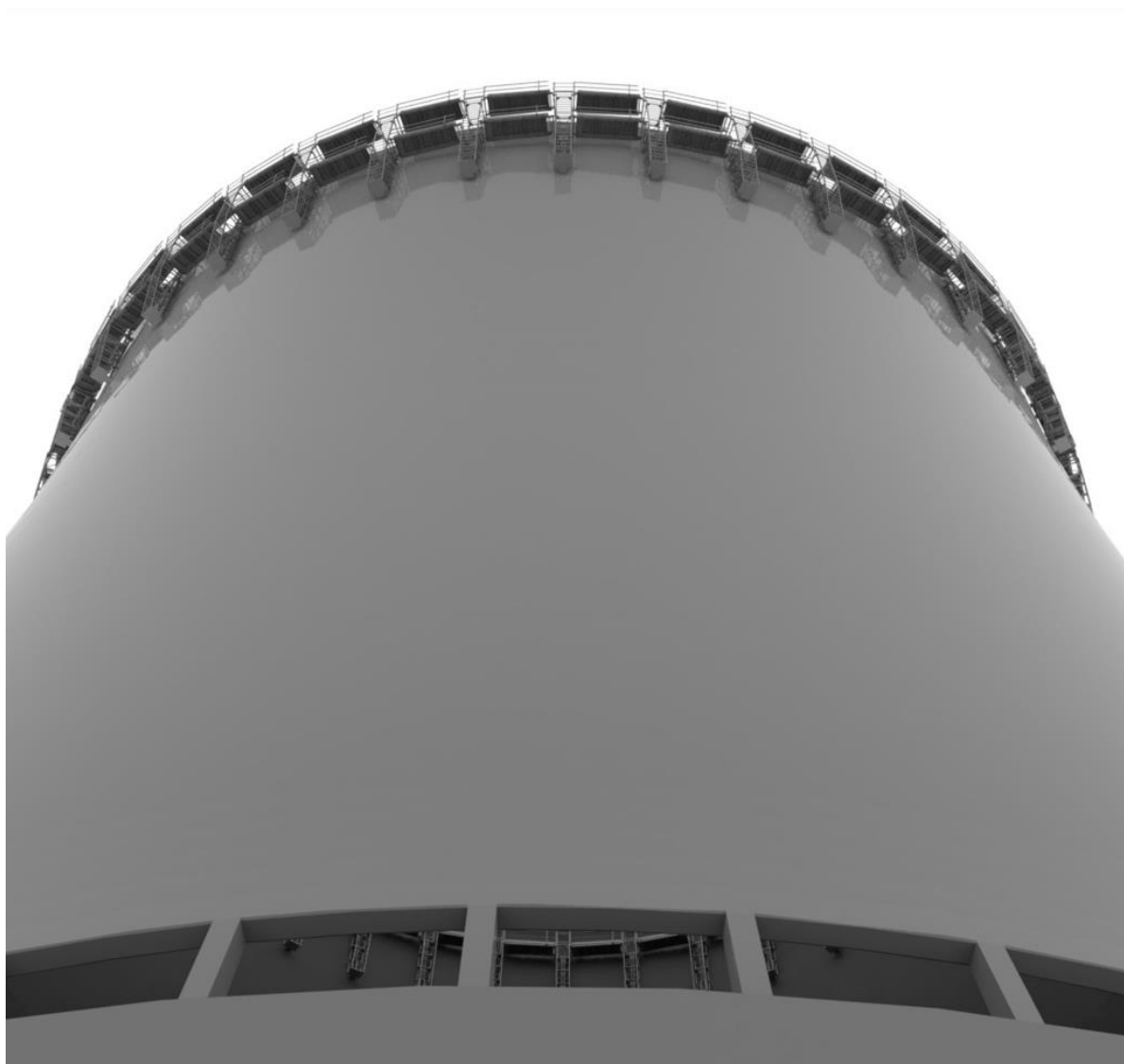
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Service organization

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www.mikrochladice.cz

Equipment registration data

Name: Soubor zařízení pro tažení plášťů chladicích věží / Set of device for cooling tower shell build up
Indication: SZ-1
Year of production: 2011
Series: 1



ES Declaration of Conformity

ES prohlášení o shodě

ve smyslu § 12, odst. 3, písm. a) a j) zákona č. 22/1997 Sb., ve znění pozdějších předpisů



Výrobce:

**CHLADICÍ VĚŽE PRAHA a.s., Politických vězňů 912/10,
110 01 Praha 1**

Výrobek:

Soubor zařízení pro tažení železobetonových plášťů chladicích věží s přirozeným tahem

Postup posouzení shody:

Posouzení shody podle níže uvedených nařízení vlády, bylo zajištěno výrobcem zařízení u akreditovaného inspekčního orgánu č. 4008 – Strojírenský zkušební ústav s. p., Hudcova 56b, 621 00 Brno a vydáno na základě inspekčního certifikátu č. I-63-0221/11/TC/K.

Zařízení odpovídá:

Nařízení vlády č. 176/2008 Sb., nařízení vlády č. 616/2006 Sb., nařízení vlády č. 17/2003 Sb.,

Použité technické normy:

ČSN EN 60204-1 ed.2
ČSN EN 60446 ed.2
ČSN EN 61000-6-3 ed.2
ČSN EN 12100-1+A1

ČSN EN ISO 14121-1
ČSN EN 61000-6-2 ed.3
ČSN EN 953+A1
ČSN EN 12100-2+A1

ČSN EN 61140 ed.2
ČSN EN 61000-6-4 ed.2
ČSN EN 983+A1
ČSN 73 2030

Potvrzení výrobce:

Jakožto výrobce výše uvedeného výrobku potvrzujeme, že vlastnosti uvedeného výrobku splňují základní požadavky na výrobky podle výše uvedených nařízení vlády. Výrobek je za podmínek obvyklého, popřípadě výrobcem určeného použití bezpečný. Výrobce přijal opatření, kterými zabezpečuje shodu výrobku uváděného na trh s technickou dokumentací a se základními požadavky na výrobky.

Označení **CE** na výrobek umístěno: **2011**

V Praze dne : 15.4. 2011

Lukáš CHMEL
Generální ředitel a předseda představenstva

EC Declaration of Conformity

in accordance with Article 12, Paragraph 3, Points a) and 1) of the Act No. 22/1997 Coll., as amended

CHLADÍCÍ VĚŽE PRAHA a.s.

CHLADÍCÍ VĚŽE PRAHA a.s., Politických vězňů 912/10,

110 01 Praha 1

Product:

Set of equipment to install reinforced concrete jackets of natural draft cooling towers

Compliance assessment procedures:

The assessment of compliance in accordance with the below specified decrees of the government was ordered by the manufacturer of the equipment from an accredited inspection body no. 4008 – Strojírenský zkušební ústav s.p., Hudcova 56b, 621 00 Brno and was issued on the basis of inspection certificate no. I-63-0221/11/TC/K.

Equipment conforms with:

Decree of the Government No. 176/2008 Coll., Decree of the Government No. 616/2006 Coll., Decree of the Government No. 17/2003 Coll.,

Used technical standards:

ČSN EN 60204-1 ed.2
ČSN EN 60446 ed.2
ČSN EN 61000-6-3 ed.2
ČSN EN 12100-1+A1

ČSN EN ISO 14121-1
ČSN EN 61000-6-2 ed.3
ČSN EN 953+A1
ČSN EN 12100-2+A1

ČSN EN 61140 ed.2
ČSN EN 61000-6-4 ed.2
ČSN EN 983+A1
ČSN EN 73 2030

Confirmation by the manufacturer:

As a manufacturer of the above specified product we hereby confirm that the properties of the said product meet basic requirements concerning products in accordance with the above specified decrees of the government. The product is safe under the conditions of usual use or use specified by the manufacturer. The manufacturer adopted measures that ensure conformity of the product being launched with technical documentation and with basic requirements concerning the products.

Symbol CE put on the product in: 2011

Prague on: 15 April 2011

Lukáš CHMEL

Chief Executive Officer and Chairman of the Board of Directors

Notes

