Cooling tower formwork

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**General system description**

The RSB climbing formwork is an anchored, fully mechanized, self-climbing system which is enclosed in the perimeter and includes all work and safety podiums for formwork, reinforcement and concreting.

The cooling tower formwork consists of independent climbing elements, which are aligned next to each other around the tower. The climbing units are identical on the inside and on the outside. The units are not connected to each other.
Climbing Units

A climbing element consists of the following elements:

- Climbing shoes
- Climbing rail
- Climbing tower
- Formwork tower with work podiums
- Steel formwork

Each climbing unit, including the steel formwork, weights about 5.2 metric tons. The upper podium can be loaded with 300 kg / m², the lower podium with 100 kg / m².
Adjustment to changing diameters
One element can be adjusted from a length of 4.2 meters to a length of 6.5 meters.

The podiums will be adjusted by sliding them together, while the handrails are simply folded together.
To adjust the formwork, elements of different sizes can be taken out or put in.

**Beginner formwork (the first 3 rings)**

In order to build the first 3 rings of the cooling tower, the same set of formwork as for the rest of the tower can be used. With the only difference, that the climbing system cannot be attached at that time, and the formwork needs to be supported by conventional scaffolding.

After the first 3 rings, the climbing shoes and climbing rail can be attached, and the coordinated climbing process can begin.
Working process for one ring

1. After the concrete (of the last ring) is poured and hardened, the formwork elements are opened. After loosening the ties, the formwork can simply be sled back on the formwork rails. This can easily be done by one person.

2. The formwork elements are moved upwards electrically by jack screws and the preinstalled climbing shoes. An electric system was chosen, because hydraulic systems tend to be very maintenance intensive and could leak oil. For safety reasons, the elements are moved up in 30 cm steps. Consecutively all elements are moved up until the section height of approx. 1,50m has been reached.

3. As soon as the first elements have reached the intended 1,50m, the formwork can be aligned and closed and the pouring of the concrete can begin. With that method, all the work on the tower can be done continuously. While element by element is aligned and the formwork is closed, the pouring process can already be carried out continuously.
4. As soon as the pouring process is finished, the rebar can be put in place (from the upper podium). This process will also be carried out continuously.

The complete process flows in a continuous manner, without downtime.

**Working schedule**

The RSB formwork is designed for a continuous working process and can therefore achieve maximum time savings. The system allows a “one day per section” rhythm. This rhythm has been tested and is easily achievable, even under difficult circumstances.
Safety

The system is approved by one of the strictest authorities in the world (TÜV- Süd, Germany), and applies to all security measures according to the latest EU machine directive (Eurocode EN1993)

Many new safety features are implemented:
- There is no connection between the elements. In case of the failure of one climbing unit, a chain reaction is avoided.
- The climbing rail is always attached to at least 3 climbing shoes. Even though one climbing shoe can hold an entire element.
- The climbing shoes which hold the elements are always mounted in – at least – three days old concrete (fully hardened)
- Elements are moved up in 30cm steps only
- Electrical driven climbing system – no hydraulic oil on the units.
- Inner and outer formwork can be moved back easily and quickly (hanging arrangement) (no crane needed).
- Due to the two podiums, all working areas can be accessed safely.

Advantages of the system

- Quick and easy assembly of the elements
- Inner- and outer-formwork can be inserted as a beginner formwork
- Section heights are variable (up to 1,50m)
- Inner- and outer-formwork can be moved back easily and quickly (arranged hanging)
- Possibility to climb over large openings
- Reinforcement can take place non-stop from the upper podium
- The length of the inner- and outer-formwork can be modified by expansions
- Quick assembly and dismantling of expansions
- Inner- and outer-podium changeable according to inclination
- There are no lost anchors. All anchors can be reused.