

# Cell Cooling Towers and System Engineering





GEA Energietechnik is part of the Thermal Engineering Division of the GEA Group and specialises in services for dry and wet-cooling towers.

#### The benefits of GEA:

- You profit from the innovative strength of a strong group
- We use the expertise of all company are as when working on your projects
- You utilise the synergies from all GEA divisions

[GEA Energietechnik GmbH]

## Member of an excellent group

GEA Energietechnik GmbH is part of the global GEA Group, which operates in more than 50 countries worldwide. It focuses on the two basic engineering processes of heat exchange and mass transfer and continues to advance the market for these key technologies.

All around the globe the energy sector, the food industry, chemical and petrochemical industries, air treatment and other sectors all benefit from the GEA Group's ability to deliver outstanding performance in the form of engineering excellence.

To meet this high-performance claim to optimum effect, the operative business of the GEA Group has been reorganised into nine divisions: Air Treatment, Refrigeration, Process Equipment, Mechanical Separation, Farm Systems, Thermal Engineering, Process Engineering, Emission Control and Pharma Systems.

Each division is completely autonomous in its respective field. Short decision-making processes and extreme flexibility are a matter of course. Thanks to the transfer of expertise, the collaboration of the divisions on joint projects utilises synergies that have a direct customer benefit.

[Wet and dry cooling systems]

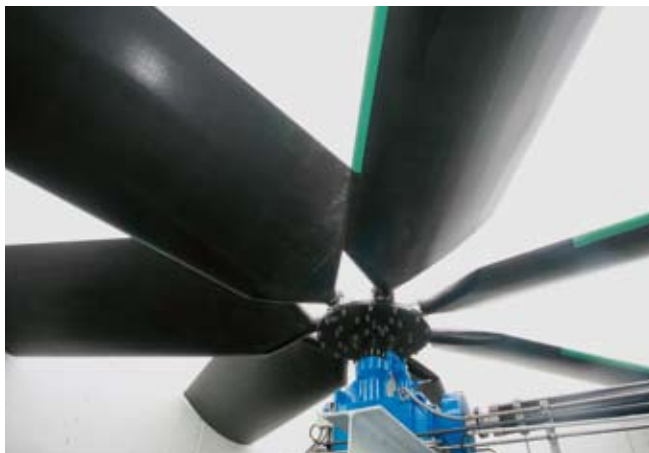
## Specialist for every type of cooling

GEA Energietechnik is known for its comprehensive expertise in the field of cooling technology and, as a company within the Thermal Engineering Division, it offers the whole range of services for wet and dry-cooling towers.

GEA's leading market position in the field of industrial cooling is partly due to its thorough command of both cooling processes. This means it is easy to achieve a smooth transition from wet to dry cooling with just one experienced contact person for both processes.

It's a well-known fact that experience pays off. For decades, GEA Energietechnik has been building cooling towers all over the world, covering everything from the construction of new towers to the enhancement, maintenance and optimisation of existing towers, always to the highest quality standards and incorporating the latest findings from its own research and development programmes. To respond with flexibility to specific customer requirements, the GEA product range comprises different types of cooling towers:

- Cell-cooling towers made of concrete, wood or glass-fibre reinforced plastic (GRP)
- Fan-assisted circular cooling towers for larger thermal outputs in concrete construction, with or without natural-draft effect
- Hybrid cooling towers, both cell and circular type, to prevent the formation of visible water vapour plumes
- Natural-draft cooling towers for large water volumes



Natural-draft cooling tower of the 'Schwarze Pumpe' coal-fired power plant in Germany with an output of 2 x 800 MW.

### The benefits of GEA:

- A single contact person for both wet and dry-cooling processes
- Global presence
- The combination of decades of experience and ongoing research and development work
- Cooling towers that are customised and bespoke to your needs

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The correct fan dimensions are crucial and ensure the long-term performance of the tower.

[GEA Energietechnik GmbH]

## Reliable and sustainable

One of the key challenges of today's technology is to design environmentally-friendly plants. At the same time, heat exchange has to take place with maximum efficiency and operating costs have to be kept as low as possible for the customer.

GEA cell cooling towers are customised to the specific application and meet these criteria in full, scoring top marks in every category. Reference towers all over the world are testimony to GEA's reliability and decades of expertise.

The economical use of resources is crucial. Modern GEA cooling towers increase the oxygen content of the cooling water before it is returned to its source. Low-noise fans and drive units, impact absorbers to attenuate the water noises or splitter attenuators make a major contribution to noise control. As many components as possible are made from polypropylene, which can be easily disposed of in an environmentally-friendly manner.

Depending on requirements, GEA cell cooling towers are equipped with the appropriate cooling technology:

- Different types of forced-draft and induced-draft fans by different manufacturers
- Spray nozzles for up and down-spray water systems
- Risers inside or outside cells
- Different cooling fills



At GEA Energietechnik, sustainable systems form the basis of the economical use of natural resources.

The benefits of GEA:

- Optimum heat exchange
- Lowest possible operating costs
- Environmentally-friendly towers
- Economical use of resources
- Environmentally-neutral disposal of various polypropylene components

[Wood, GRP and concrete construction]

## As unique as the requirements – System Technology from GEA Energietechnik

For GEA, good is simply not good enough. This is why, in addition to its tried-and-tested cell cooling towers, GEA also offers individual complete turnkey systems customised to the specific application.

The cooling tower is the heart of every plant and, depending on requirements, has a concrete, GRP or wooden structure.

However, a system operates most efficiently when the cooling tower and all other components have been carefully co-ordinated. „System Technology“ means - GEA as your partner in the field of wet cooling, offers complete turnkey systems with carefully selected individual components. The scope of supply includes: pumps; fittings; pipework; heat exchangers; electrical, measuring and control technology; as well as chemical and mechanical water-treatment systems within the defined interfaces. If required, GEA will also provide the reinforced-concrete structures, as well as all the associated services. During the tendering phase, highly qualified employees work with the customer to develop individual, technically feasible solutions for every conceivable interface that can then be integrated smoothly into the plant's processing sequences.

The customer thus receives a system that has been specifically tailored to the particular situation and one that meets all requirements and expectations.

This is what GEA understands by engineering excellence: customers benefit directly from the expertise and innovations of specialists working in the different areas of the company. The process creates an optimum plant that is both cost-effective and tailored to the particular application.

The benefits of GEA:

- Towers that meet customer specifications
- Use of the expertise of the entire GEA Thermal Engineering Division
- Complete turnkey systems
- No interface problems



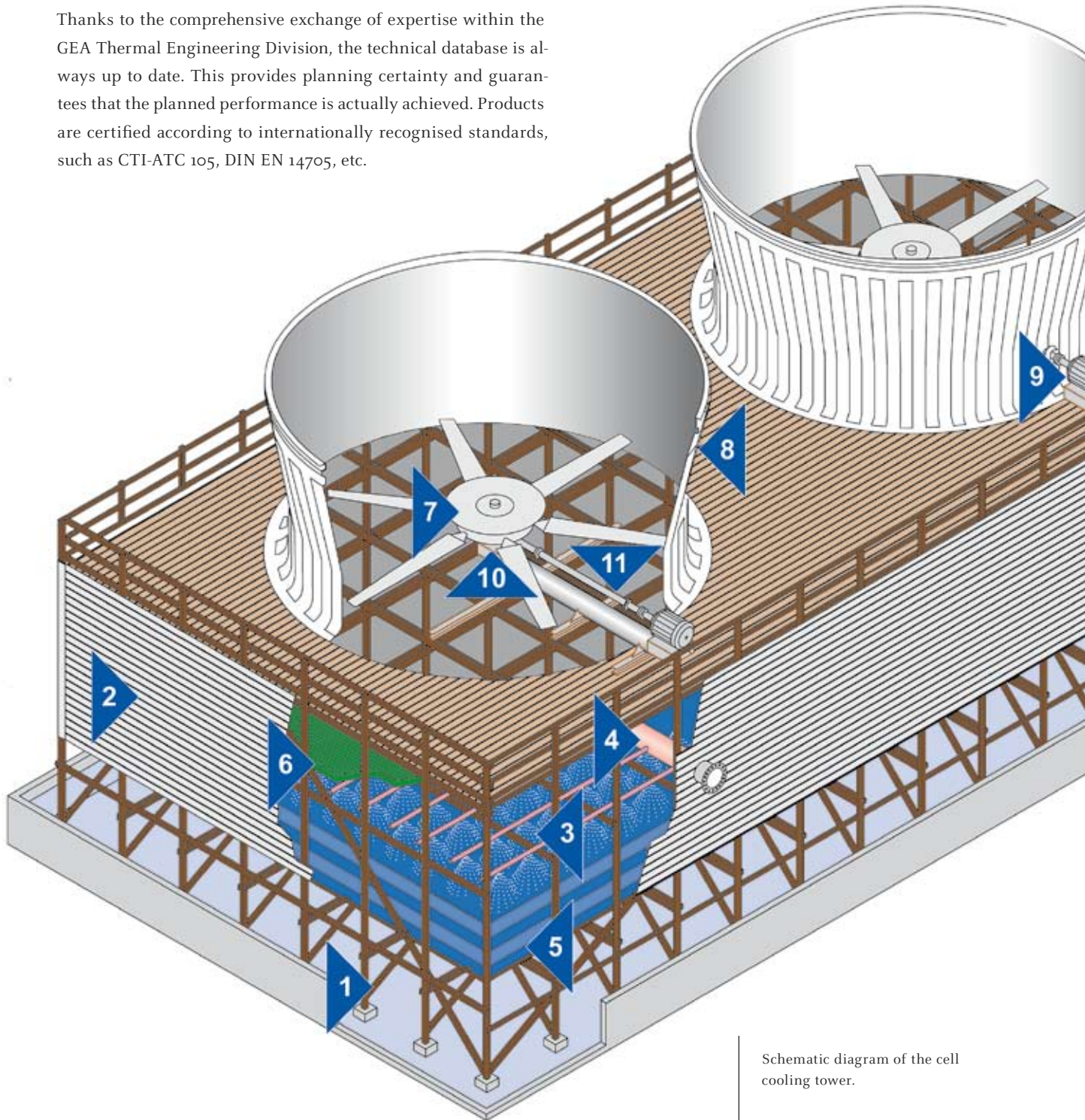
Customised and cost-effective plants with a compact design made of concrete, GRP and wood. The modular structure of cell cooling towers allows a high degree of prefabrication and thus short construction times.

[Expertise is about understanding the whole]

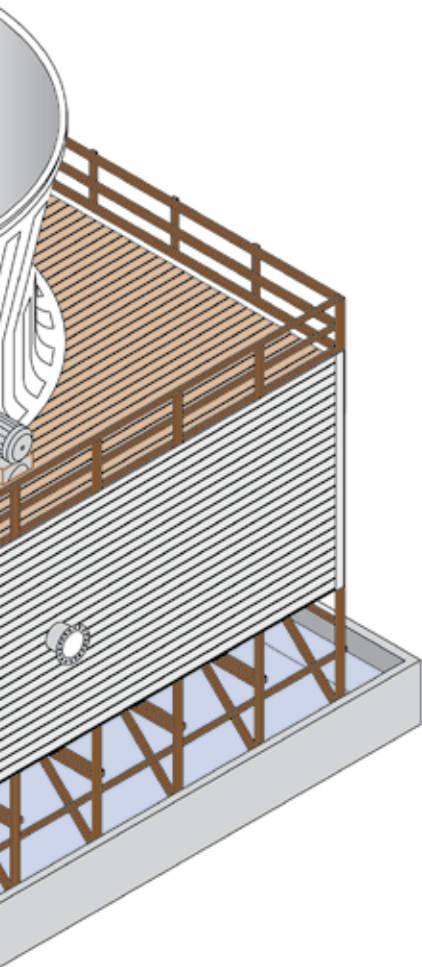
## Made in Germany – made by GEA

The cooling fills used in GEA cooling towers are subjected to ongoing checks and improvements in the company's own laboratories and test facilities.

Thanks to the comprehensive exchange of expertise within the GEA Thermal Engineering Division, the technical database is always up to date. This provides planning certainty and guarantees that the planned performance is actually achieved. Products are certified according to internationally recognised standards, such as CTI-ATC 105, DIN EN 14705, etc.



Schematic diagram of the cell cooling tower.



### 1. Cooling tower structure

Depending on the application, made of in-situ concrete, pre-cast concrete parts, impregnated wood, galvanised steel, stainless steel or GRP profiles - with stairs, ladders, rails and accessories.

### 2. Cooling tower shell

With windwalls and partitions made of in-situ concrete, impregnated wood or glass-fibre reinforced plastic.

### 3. Water distribution

Main distribution pipe made of steel, GRP, PP or HDPE piping, wooden or concrete channel, secondary distribution pipe made of PP or PVC piping, wooden or GRP channel.

### 4. Spray nozzles

High-performance spray nozzles for up- and down-spray water systems with blockage-free nozzle fittings.

### 5. Cooling fill

PP, PPS or PVC high-performance film-type packing, for water with higher suspended solids content, PP or PE splash-type fills, wooden or stainless steel laths, bricks and other special materials.

### 6. Drift eliminator

For low drift loss, made of PP or PVC corrugated profiles or films.

### 7. Axial fan

With adequate pressure reserve and high efficiency. GRP or aluminium blades with steel hub that are vibration-controlled and that can be adjusted when at rest.

### 8. Diffuser

To optimise performance via pressure recovery, made of glass-fibre reinforced plastic, in-situ concrete or pre-cast concrete parts.

### 9. Electric motor

Single-speed, pole-changing or frequency-controlled, squirrel-cage motor for low or medium voltage.

### 10. Gearbox

Large, two or three-stage, bevel-helical gearbox; on request, available with oil pipes routed to the outside and monitoring devices.

### 11. Drive shaft

Made of high-quality carbon-fibre composite material with carbon-fibre couplings, coupling protection and guarding protection.

[Long service life]

## Concrete cooling towers

The main features of concrete cooling towers are their long service life and very good sound absorption. When using high-strength cement and the appropriate coating, they can also be used with aggressive cooling water

The following construction variants are possible:

- In-situ concrete construction
- Prefabrication to minimise construction time
- Mixed construction

The supporting structure is designed according to the respective static requirements.

With prefabricated construction, the mainstays, which are fixed in sleeve foundations, carry the load and have support brackets for the horizontal beams. External horizontal beams hold the external cladding in place. Depending on the wind loads that occur, the vertical gap between beams can vary.

On the inside, beams form the supporting structure for the internal parts of the cooling tower. In-situ concrete or prefabricated reinforced concrete parts are used in the roof area. In-situ concrete, prefabricated concrete parts, corrugated GRP panels, steel or aluminium trapezoidal sheet or other panelling are the material of choice for the outer walls.

Plants with multiple cooling cells necessitate the use of cell partitions. In these cases, walls can be made of in-situ concrete, prefabricated reinforced concrete parts or asbestos-free, fibre-reinforced concrete panels. The same applies to windwalls in cells with two-sided air intake. Each cell is accessible via an opening in the fan deck. Ladders and walkways facilitate access to the fan, gearbox and drive shaft.



The combined gas and steam turbine power plant in Timelkam, Austria with a four-cell cooling tower.

[Reduced assembly times]

## Wooden cooling towers

For decades, thanks to their universal application, wooden cooling towers have proven successful in all branches of industry. Together with suitable accessory materials, for example for seawater, they can be used without restrictions.

The dimensions of a GEA wooden cooling tower are based on a defined support grid. A number of these grids are used to adapt the cooling tower with flexibility to different space requirements. Prefabricated wooden elements reduce assembly times considerably compared with concrete cooling towers.

The supporting structure for the cooling fills, fan deck and any sound insulation that may be required consist of a stable, wooden framework; in the roof area, tongue-and-groove formwork or weather-resistant, glued plywood is used. All woods comply with the latest standards and guidelines for use of wood in cooling-tower construction. After processing (joining), the material is treated via a vacuum/pressure impregnation method with a tried-and-tested wood preservative. Connecting elements, such as bolts, screws, wood fasteners, etc. as well as the diagonal braces necessary to absorb wind loads, are matched to the quality of the circuit water.

Windwalls and partitions on the inside and the external cladding are made of pressure-impregnated, tongue-and-groove formwork. As an option, corrugated, fibreglass reinforced plastic or coated steel or aluminium profiled panels can be used on the outside. The structure of the external cladding can be adapted to meet the relevant application to meet particularly high noise-regulation requirements.



The geothermal power plant in Unterhaching/Germany. From a depth of 3,300 metres, Germany's largest geothermal borehole produces a supply of water for energy generation at a temperature of 60 to 122 degrees at a rate of 150 litres per second.



A special example of modular construction: the 1,100 MW combined cycle power plant in Florida/ USA with 24 cell cooling towers made of glass-fibre reinforced plastic.

[Great flexibility]

## GRP cooling towers

Due to its outstanding technical properties and extremely high resistance to corrosion and weathering, glass-fibre reinforced plastic (GRP) is increasingly replacing constructions made of traditional materials.

Thanks to GRP profiles that are subjected to static dimensioning during the planning phase, GEA offers tremendous flexibility with regard to cell dimension and the choice of bearing distance. GEA only uses GRP profiles that meet international standards (DIN, EN, ASTM, CTI, etc.) and that have been certified by various material testing authorities.

All components used are UV and fire-resistant in accordance with specific requirements. Depending on the composition of the circulating water, the connecting elements consist of hot-galvanised steel, stainless steel or suitable plastics. It is possible to meet customer requirements for specific colours by adding coloured pigments.

The following GRP components are used:

- Supporting structure made of GRP profiles
- Partitions and external cladding made of trapezoidal or corrugated sheet
- Fan rings and diffusers
- Caged ladders, handrails and access platforms
- Roof planks on the fan deck made of special, non-slip base plates
- Water distribution pipes



The GRP supporting structure in the cooling tower offers both high strength and lightweight properties.

[Maintenance, service and optimisation]

## Service for high productivity

GEA services go beyond plant completion. GEA offers a broad range of services for cooling towers and system technology that features all the benefits of GEA expertise.

Plant upgrades to increase performance or to exchange cooling fills are available with GEA's own tried-and-tested products. The guaranteed properties and performance values have been proven many times over in applications in the world's largest, state-of-the-art cooling facilities.

Inspections and regular servicing are crucial. The results of the inspections can be analysed, either online or on-site, in collaboration with the specialist engineers and technicians of GEA Energietechnik.



Online fault management: solutions are developed in direct consultation with the customer.



Visual inspections play an important role at GEA. They enable early fault detection and elimination.

### The benefits of GEA

- Calculation, simulation and optimisation of planned upgrades
- Guaranteed performance
- Inspections and servicing during planned shutdowns
- Replacement and renovation of components made of wood, GRP, steel, concrete and plastic
- Monitoring and maintenance of all of the system components. Service contracts and service agreements, planned maintenance inspections and condition reporting



Thermal Engineering

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