

*/ Natural Draught Cooling Towers  
A positive natural trait /*



**SPX** Cooling Technologies

Balcke | Hamon Dry Cooling | Marley

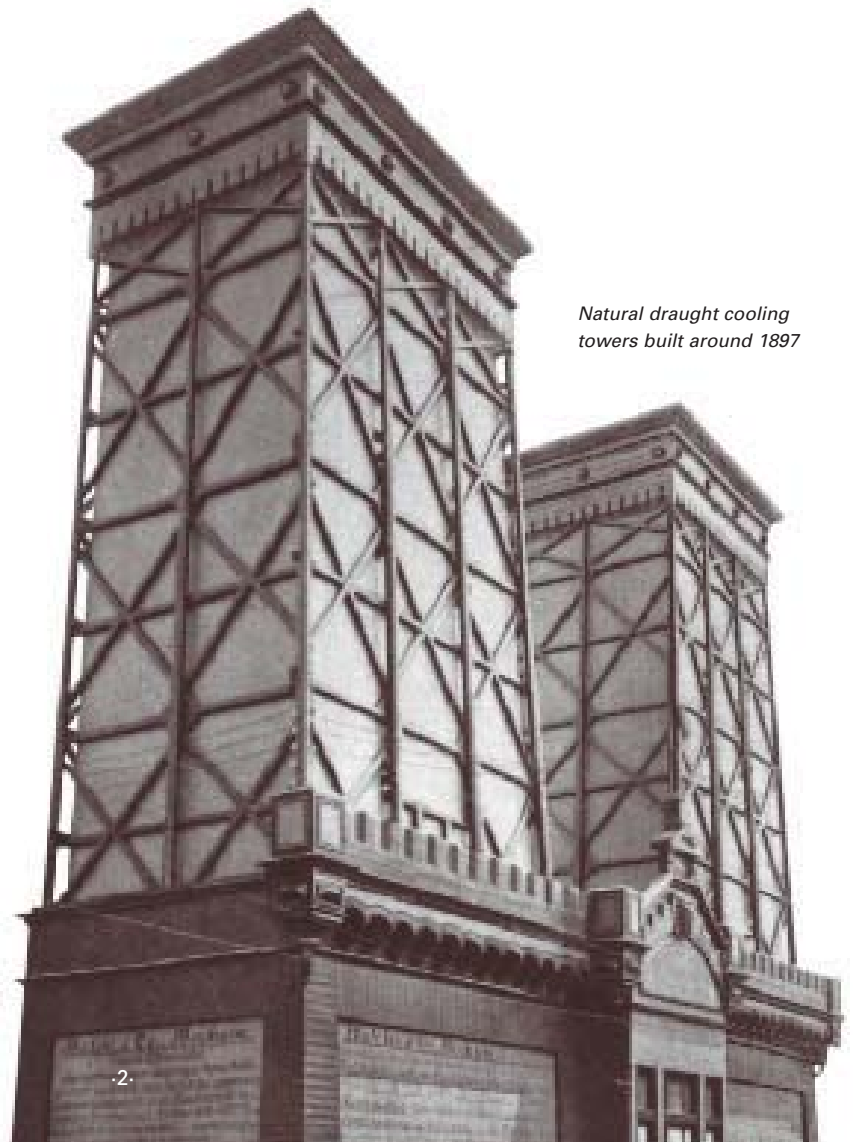
## */ Cost saving through repeated use /*



### */ For more than a century we have been building cost-saving cooling towers /*

Providing cooling water is of vital importance to every plant engineer and operator. It is ineffective both ecologically and economically to use water only once and then return it to an effluent system. This problem is resolved by using a cooling tower to cool and recirculate the water used.

SPX Cooling Technologies is your competent partner for designing and building economic cooling towers.



*Natural draught cooling towers built around 1897*

***/ Particularly interesting for larger units /***

This brochure presents the SPX Cooling Technologies product segment, natural draught cooling towers. As in a chimney structure, natural draught conveys the cooling air required for this type of cooling tower. The air cools the trickling cooling water by absorbing heat and moisture. As this cooling tower operates without any fans, the substantial amount of the electric power otherwise required for large cooling tower systems is not needed.

That makes natural draught cooling towers particularly attractive as a cost-saving solution for larger power stations and chemical plants requiring greater quantities of cooling water.



*Cooling tower simultaneously used to discharge treated flue gases from the 550 MW power generating unit of a coal-fired power station*



*Natural draught cooling tower at a large power station: sound attenuators at the air inlet reduce sound emissions*

***/ Economically efficient all along the line /***

Natural draught cooling towers have one very decisive additional advantage for coal-fired power stations. The treated exhaust gases from the flue gas desulphurisation plant can be discharged via the cooling tower. This means that neither chimney nor flue gas reheating are required. *(Please refer to page 10).*

## ***/ The cooling fill – heart of the cooling tower /***

The cooling fill is the most important part of a cooling tower, its “heart” so to speak. As a contact surface it must ensure optimal heat exchange between water and air. It is individually selected for each particular application.

SPX Cooling Technologies cooling towers are mostly designed as counterflow cooling towers. In this construction the water to be cooled trickles from the top through the cooling fill whilst the air is drawn or forced through the fill from the bottom.

Cooling is achieved both through evaporation of a small quantity of the water, latent heat being taken from the cooling water flow, and also through transfer of heat from the water to the cooling air by convection.

### ***/ Cooling fills – as varied as the local water qualities /***

- **Foil packs made of plastic foils glued or welded together**

This fill achieves the greatest cooling effect and consequently the price/performance ratio of the cooling towers is extremely favourable. The cooling water quality must, however, comply with stringent requirements. SPX Cooling Technologies has developed its own types of foil for different water qualities which have proven themselves in practice (*figure 1*).

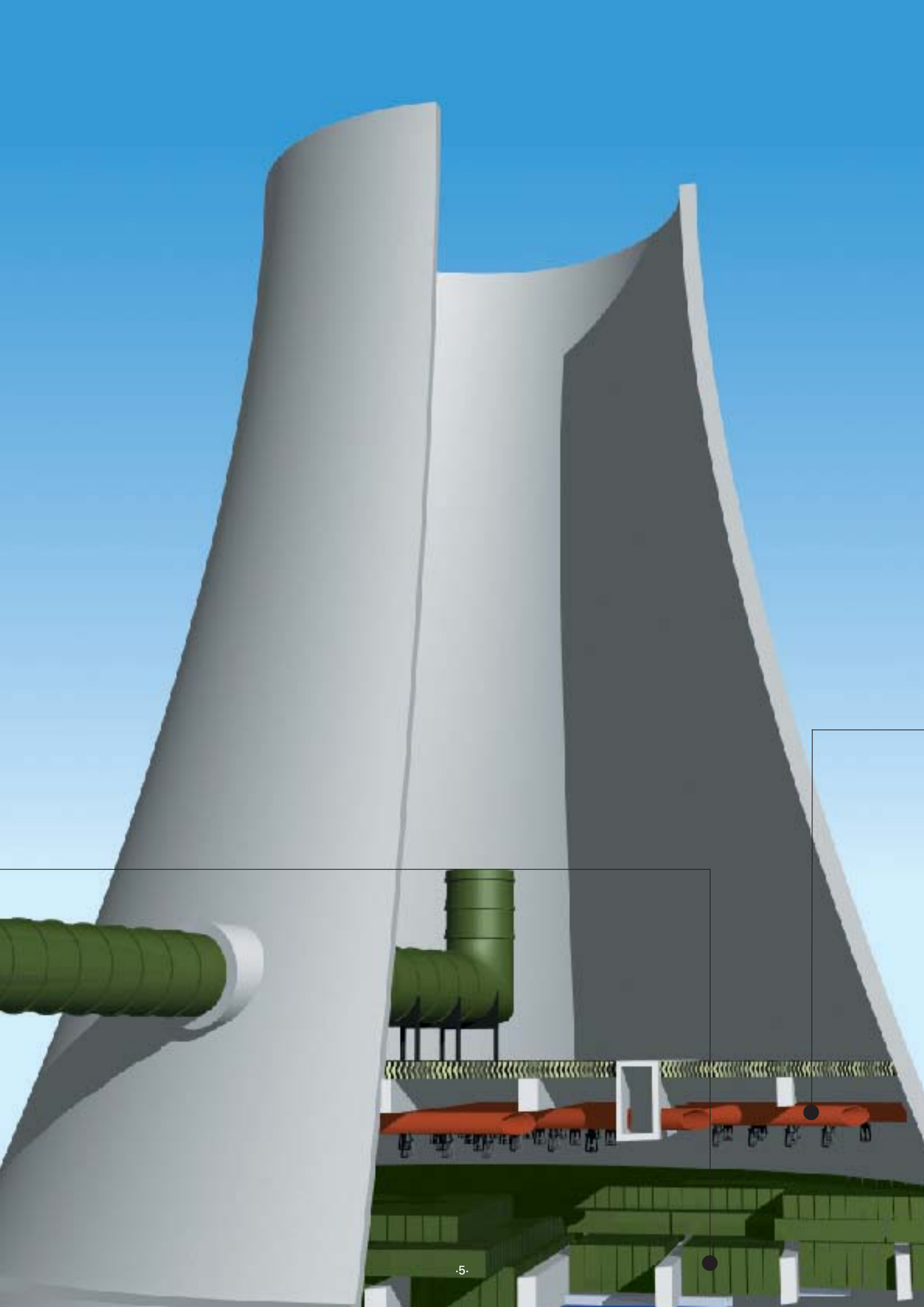
- **Trickle grids or trickle blocks made of synthetic material**

A SPX Cooling Technologies fill which is not only robust and stable but also easy to clean. Cooling towers equipped with this fill have been operating successfully for many years. Many operators prefer this fill because it is robust and less susceptible to fouling than foil packs, although its thermal performance is slightly lower than that of the SPX Cooling Technologies foil type fill (*figure 2*), and therefore a larger quantity is needed.

- **Splash grids made of synthetic material**

A highly resistant cooling fill for poor water qualities (*figure 3*).





## */ Water distribution system – a criterion for effectiveness /*

Optimal water distribution also has a decisive influence on the economic efficiency of a cooling tower. It comprises a thoroughly elaborated system of risers and main distribution channels to which the individual distribution pipes are connected.

Thanks to the design of the water distribution systems in our natural draught cooling towers it is possible to charge only certain sections of the tower with water when only part of the cooling water is being recirculated.



*One of the vital details:  
the SPX Cooling  
Technologies sprayer*

### */ High performance despite low nozzle inlet pressure /*

Our sprayers are fitted to the bottom of the pipes and channels. They distribute the water over the cooling fill as uniformly as possible, this being essential for the fill to function optimally. As the distribution system sprays the water downwards, only a low nozzle inlet pressure is required. Dirt particles in the cooling water are constantly flushed out of the pipes. The entire system drains automatically and therefore freezing cannot occur in winter. The sprayers are not susceptible to contamination.

### */ Drift eliminators prevent water losses /*

Drift eliminators made of synthetic material are installed above the water distribution system to prevent water droplets from being entrained. They ensure compliance with the high elimination rates required in line with current environmental protection regulations.

## */ Reliable operation also during the cold season /*

Our natural draught cooling towers are designed to operate reliably during the winter if applicable for the location.

Cooling towers built according to counterflow design are of significant advantage in winter as the cooling air first comes into contact with the trickling water and is preheated before reaching the cooling fill.

Individual sections of the water distribution system can also be isolated. The internal sections of the water distribution are drained and the outer sections hydraulically overloaded. Some of the cooling water can also be conveyed uncooled directly into the basin via overflow ducts. The thermal efficiency of the cooling tower decreases.

### */"Winter pipes" to prevent ice formation /*

"Winter pipes" are arranged at the lower edge of the cooling tower shell. They have a large number of openings on the underside and are charged with part of the cooling water flow. The winter pipe produces a water screen at the air inlets which restricts the cooling air inlet flow and also preheats the cooling air.

By suitably combining the above-mentioned modes of operation, reliable functioning is guaranteed down to minus 30 °C.

SPX Cooling Technologies natural draught cooling towers are used in many regions where winters are always cold such as Russia, Scandinavia or northern USA because they are renowned for operating reliably under winter conditions.





Natural draught cooling tower with meridional columns. Start of the climbing formwork.



Wind tunnel tests at a university

Civil engineering is also one of the services offered by SPX Cooling Technologies. Our company is not only experienced in the thermal and hydraulic design of natural draught cooling towers. Our specialists also have the necessary expertise in civil engineering. That means: we supply entire natural draught cooling towers – both civil engineering and “what belongs inside”.

## ***/ Civil engineering also from a competent source /***

In close co-operation with local affiliates, licensees and other partners we can supply the complete civil engineering.

## ***/ The reinforced concrete shell – an architectural masterpiece /***

The trend towards increasingly large cooling towers started more than a century ago with the construction of the first Balcke chimney cooler which had a modest height of 12 m. Nowadays towers with heights of more than 200 m built using so-called climbing or sliding formwork do not present a problem with regard to civil engineering.

The shell of cooling towers 200 m high with diameters of about 150 m is extremely thin, measuring just 200 mm or less. That means that the reinforced concrete shell is relatively speaking thinner than an egg shell, as demonstrated by scale models. And despite this it is

“firm as a rock” even under high winds and seismic loads. We have extensive experience in this respect. Tests are carried out in a wind tunnel to simulate special conditions, such as several cooling towers arranged either in line or in groups.

The type of foundation required for each cooling tower, e.g. individual foundations, ring foundation or piling, is determined according to the ground conditions.



## / Effective sound attenuation – Noise barriers for neighbouring residents /

Sound attenuators in front of the air inlets – the most effective means to reduce noise emission

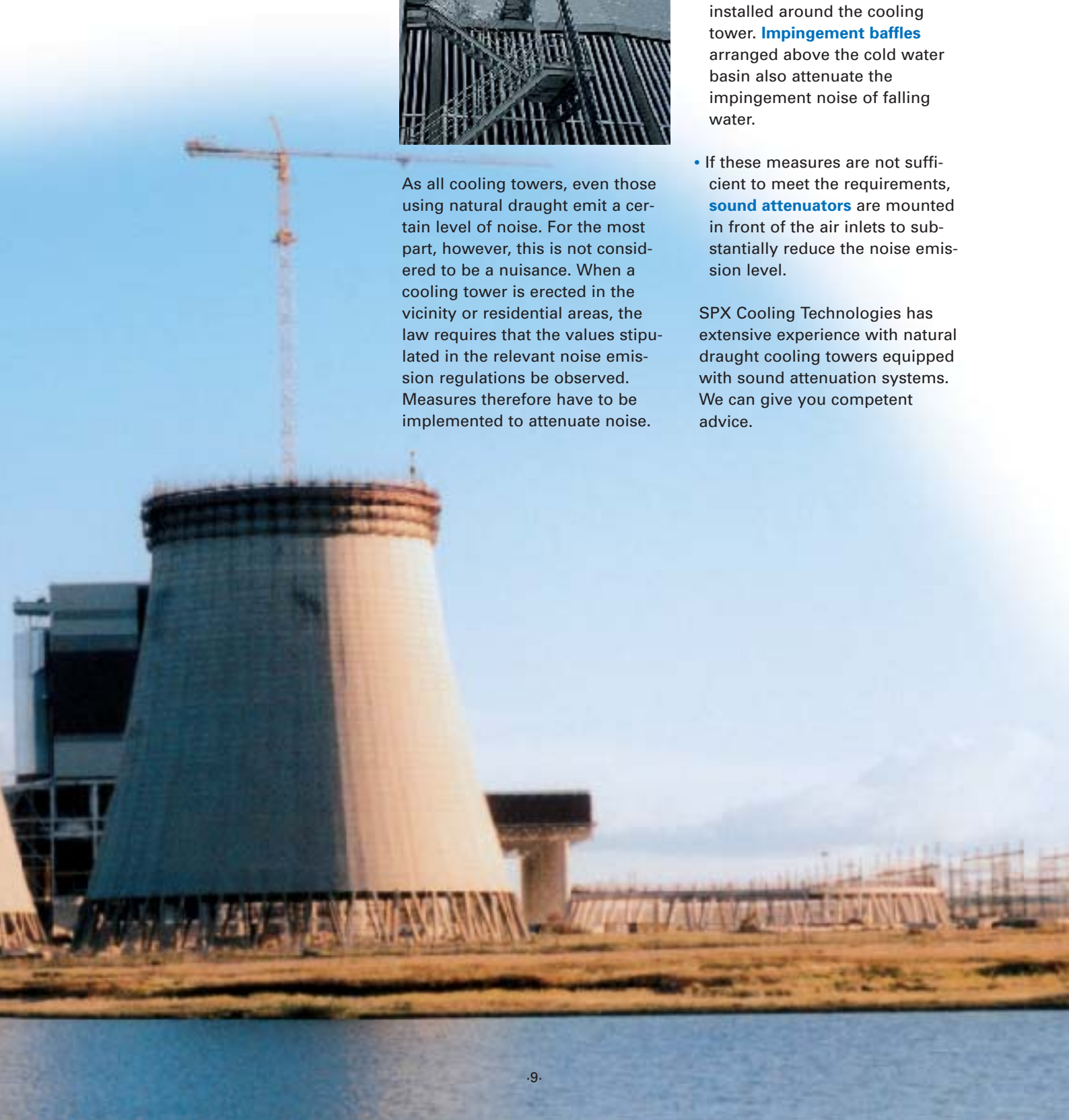


As all cooling towers, even those using natural draught emit a certain level of noise. For the most part, however, this is not considered to be a nuisance. When a cooling tower is erected in the vicinity or residential areas, the law requires that the values stipulated in the relevant noise emission regulations be observed. Measures therefore have to be implemented to attenuate noise.

### / Various options are available: /

- If the required sound attenuation is comparatively low, **sound attenuation walls or mounds** are installed around the cooling tower. **Impingement baffles** arranged above the cold water basin also attenuate the impingement noise of falling water.
- If these measures are not sufficient to meet the requirements, **sound attenuators** are mounted in front of the air inlets to substantially reduce the noise emission level.

SPX Cooling Technologies has extensive experience with natural draught cooling towers equipped with sound attenuation systems. We can give you competent advice.



## ***/ Discharge of treated flue gases – With neither reheating system nor chimney /***

A new development over the past few years is the system to discharge treated flue gases via natural draught cooling towers. Under normal circumstances, flue gases from coal-fired power stations have to be reheated after desulphurisation in order to discharge them via a chimney.

A cost-saving flue gas discharge concept was developed to eliminate the necessity for energy-intensive reheating and the construction of a chimney.

SPX Cooling Technologies has also developed a special system for this. The treated flue gases are conveyed into the cooling tower through one or two glass-fibre reinforced plastic ducts and discharged into the atmosphere together with the cooling tower plume.

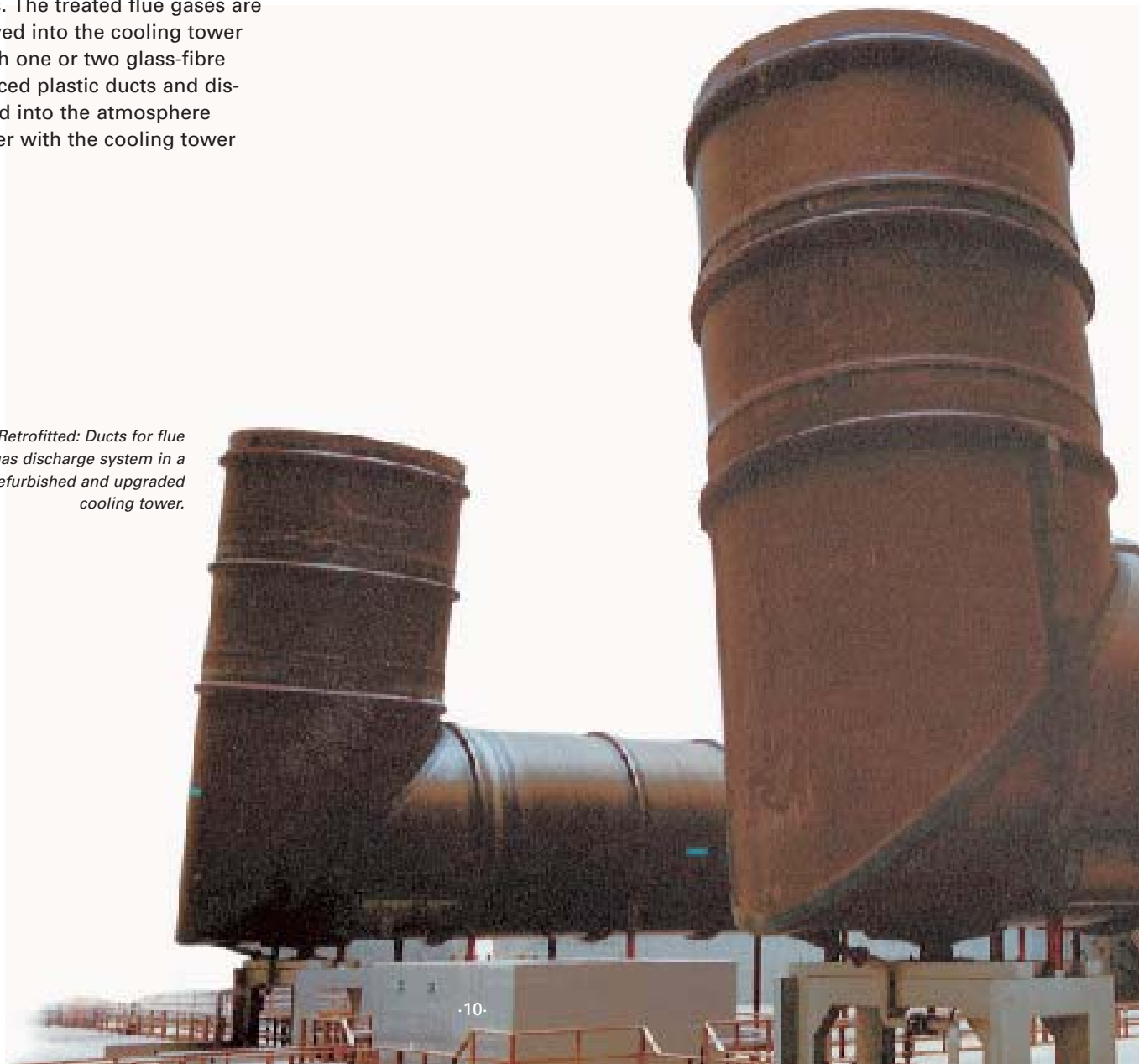
### ***/ Flue gas discharge system – also for existing cooling towers /***

The principle of discharging flue gases via the cooling tower is not only applied in new cooling towers. Existing, less modern cooling towers can also be retrofitted with this state-of-the-art technology. Many cooling towers retrofitted with such flue gas discharge systems are in daily use and fully meet all expectations.



*Flue gas duct entering the cooling tower of a coal-fired power station*

*Retrofitted: Ducts for flue gas discharge system in a refurbished and upgraded cooling tower.*



## */ Team-work to the benefit of our customers /*

### */ Together we are strong /*

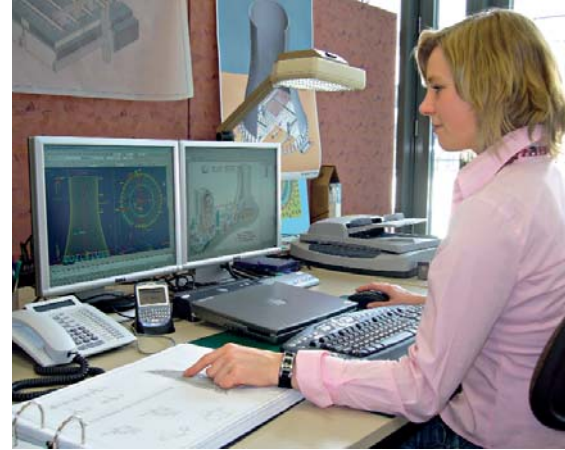
Specialists for thermodynamics, hydraulics, process engineering, instrumentation and control, statics and civil engineering work together in our multidisciplinary engineering team.

Our research and development centre has state-of-the-art equipment and highly qualified personnel at its disposal to meet your requirements. What is more we constantly exchange information with institutes of technology and universities. Your assignments are therefore in very good hands at SPX Cooling Technologies. A competent partner. Even for unusual problems.

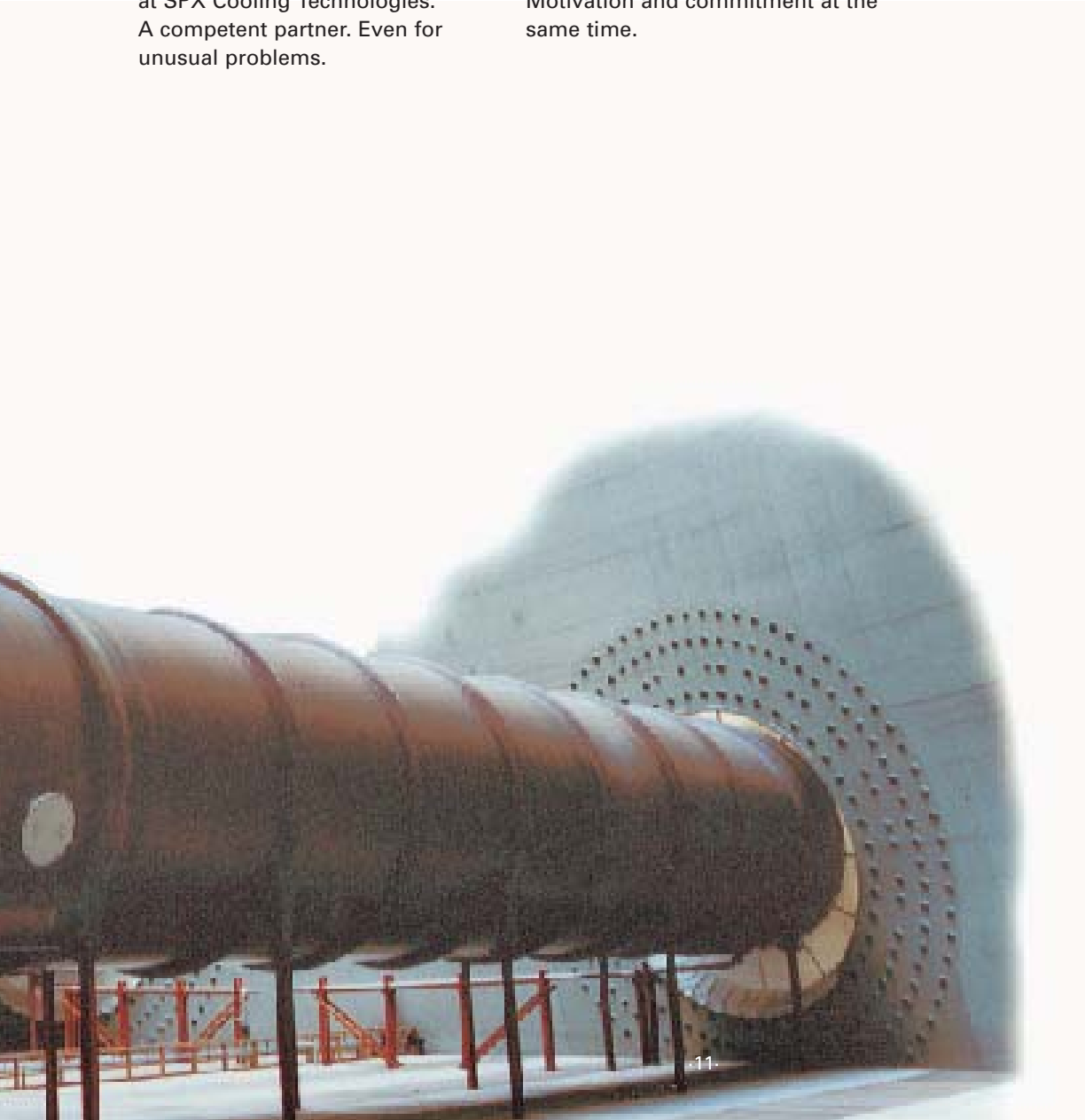
### */ With help and advice where required /*

You now have some information on natural draught cooling towers. Should you have any queries about this or need information concerning a specific cooling problem, please call us or write to us. "Us" means SPX Cooling Technologies GmbH in Germany or our affiliated companies in other European countries and overseas.

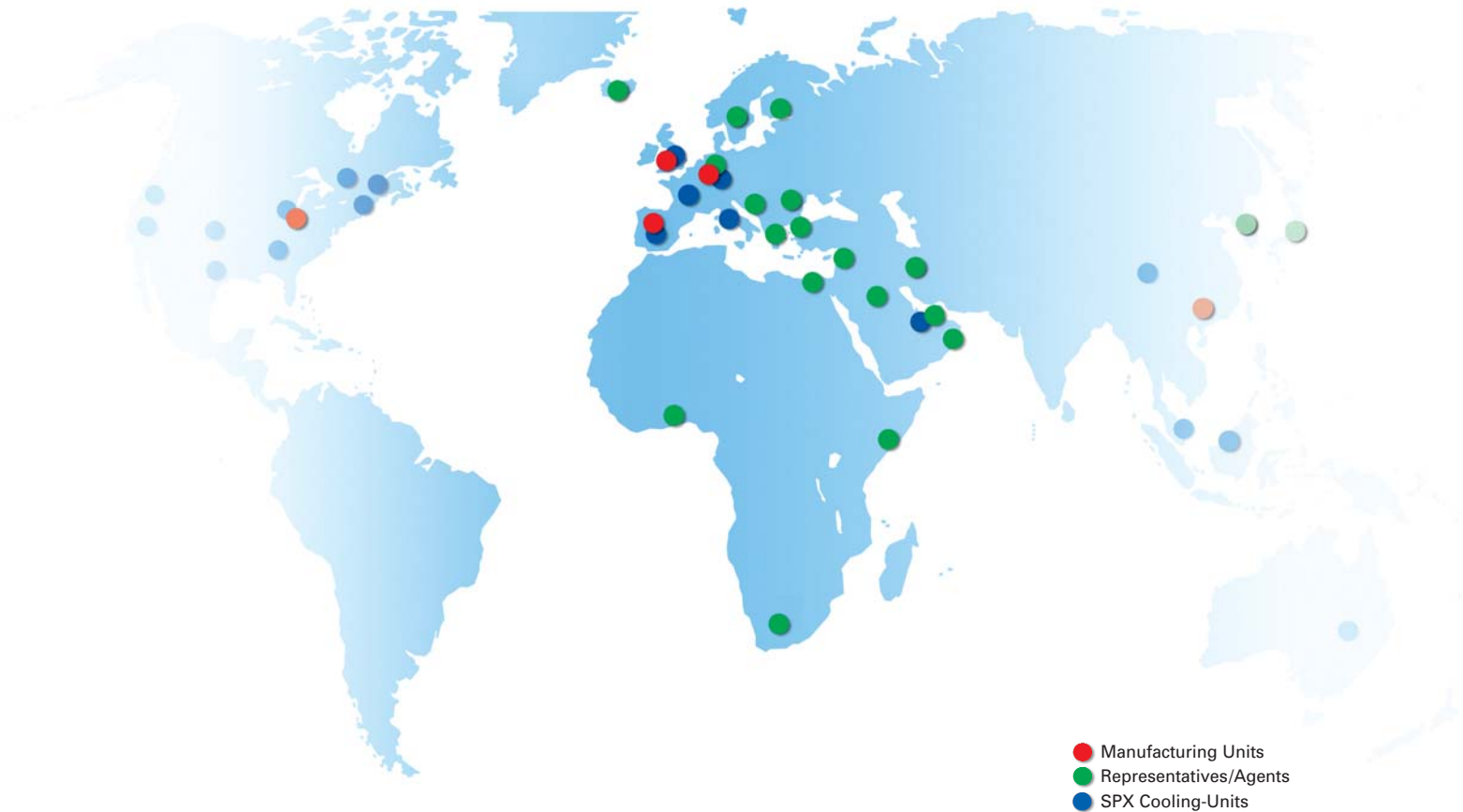
We are always at your disposal to deal with challenging problems – and invariably we find a solution. "Tricky" jobs are our speciality. Motivation and commitment at the same time.



*With state-of-the-art equipment and committed personnel we find the ideal solution to every problem.*



## */ Worldwide Competence in Cooling /*



**SPX** **Cooling Technologies**

Balcke | Hamon Dry Cooling | Marley

SPX Cooling Technologies GmbH  
Ernst-Dietrich-Platz 2  
40882 Ratingen  
Germany  
Phone: +49 (0) 2102/16 69-0  
Fax: +49 (0) 2102/16 69-699  
info@cts.spx.com  
www.spx-ct.com