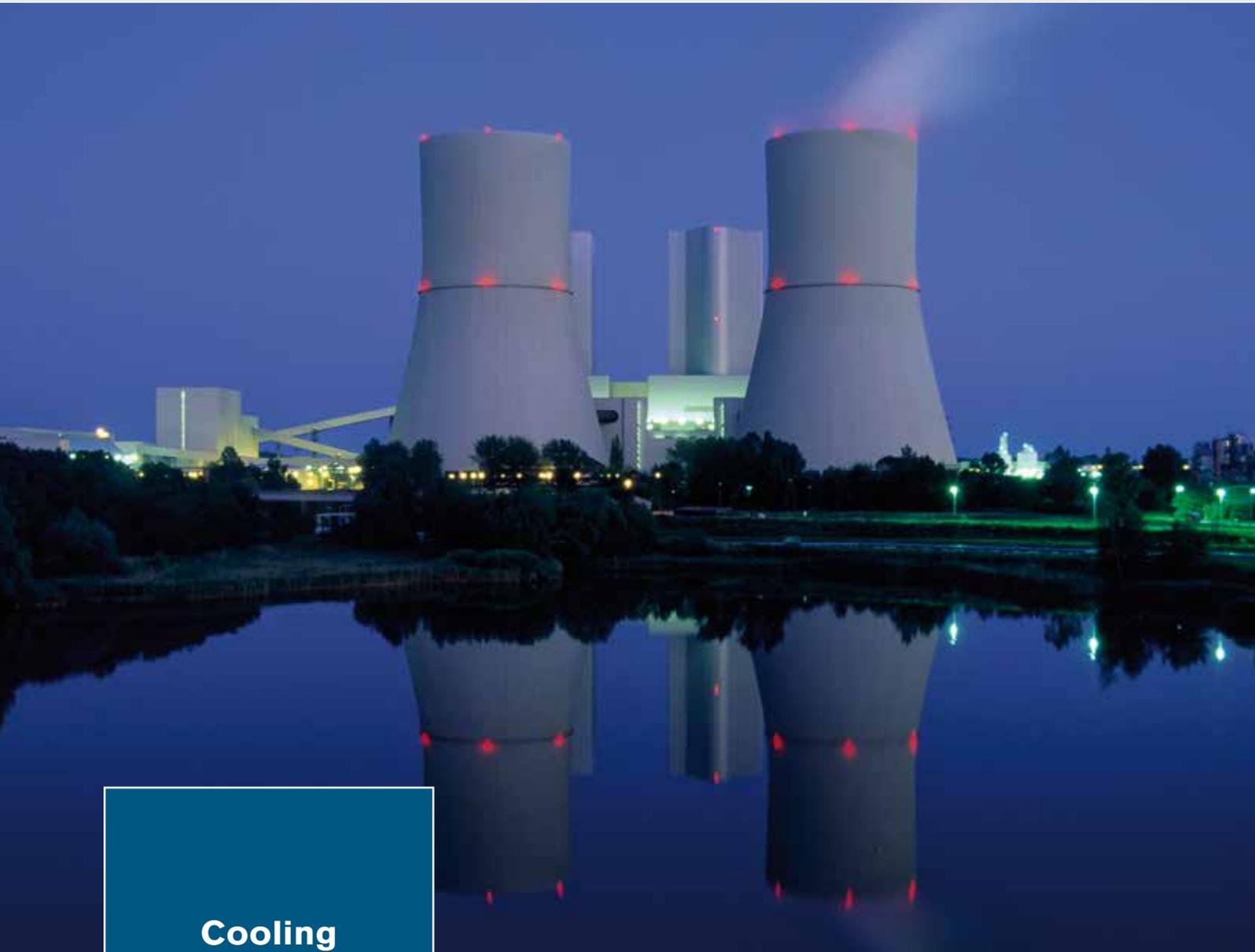
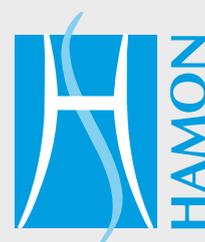


Hamon Wet Cooling Systems



**Cooling
towers**



Why wet cooling?

Wet cooling offers an outstanding performance by taking full advantage of the ambient air humidity. Wet cooling, also called evaporative cooling, enables to obtain a re-cooled water temperature at least 20°C lower as compared to a radiator. As turbine output and hence power plant output increases by 0.3 to 1 % per degree of better cooling, wet cooling is a technology that can generate outstanding fuel saving and carbon emission reduction.

Does wet cooling use a lot of water?

One to two percent of the water is evaporated only. For this reason, a closed loop circuit with a cooling tower needs make-up water from an external source (river , lake, sea).

The make-up flow depends on the raw water hardness and is limited to maximum 4% in most cases. The water that is not evaporated is returned to the external source. During its transit in the cooling system, the water is never in contact with any fluid from the factory process and therefore cannot be polluted by it.

Can a cooling tower be more advantageous than a once-through sea cooling?

As explained on page 10, a case by case economic and impact study should be done for each case comparing once-through and closed loop cooling. Conclusion will probably show how cooling tower would be much more attractive!

Hamon: more than 100 years experience

Numerous installations and equipment—more than 5400 references—operating worldwide in a wide range of industrial plants are evidence of Hamon's capabilities and experience. Whatever the industry you name, Hamon has supplied cooling towers for it: power plant, refinery and downstream petrochemical plant, fertiliser, paper industry, steel mill, sugar mill, zinc smelter and other metallurgical installation, chemical plant, etc.



Hamon field ere

Network

Hamon Thermal Europe with its engineering department and R&D center supports a network of factories and sister companies, which locally assure contracting, procurement and field services. Hamon offices are based in the UK, Germany, Spain, Italy, Poland, Russia, Spain, Turkey, US, Australia, South Africa, United Arab Emirates, China, India, Korea, Indonesia, Thailand, Vietnam, Brazil, Colombia...





ected cooling towers: engineered by experts



Our commitment to the industry

Hamon Thermal aims at offering the best economical solution for the whole lifetime of **field erected cooling towers**. Hamon cares for most of the industries and its expertise covers:

- Thermal, hydraulic and structural design
- Noise and plume abatement as well as other environmental aspects
- Selection of associated equipment such as: pumps, piping, electrical and instrumentation, water treatment, lighting, etc,
- Civil work construction and mechanical erection
- Commissioning, testing and auditing
- Upgrading, repair and maintenance
- Dismantling and recycling (also PVC film)

Depending on the application requirements, the equipment is designed to customer preferred combination for efficiency, long-life expectancy, power saving and respect of environmental local regulations.

In order to meet these specifications a **wide choice of solutions is available in layout, arrangement, structure, internals and mechanical equipment.**





Fan assisted natural draft

Best solution when

- Available plot area and/or height are limited
- Important heat load variation are expected



NDCT Refurbishment

- Restoration or improvement of the CT performance
- Experienced teams used to work during limited shutdowns
- Removal and replacement of asbestos cement sheet
- Recycling and re-use of PVC



Flue gas dispersion through NDCT

- Applicable in thermal power plants
- No large chimney necessary
- Better flue gas dispersion
- Hamon design



In the seventies and early eighties, many large power plants were built and equipped with tall natural draft cooling towers (NDCT) in Europe, US, South Africa, India, China, etc.

Nowadays, many natural draft cooling tower projects have been launched worldwide as this type of tower is now regarded as environmentally friendly thanks to the power saving that they generate.



Natural draft cooling towers



Beyond the power saving, NDCT offers the following advantages:

- limited plot area
- no mechanical noise (no fan)
- limited maintenance
- high longevity (generally more than plant life expectancy)

The payback period of an NDCT is 8 to 16 years depending on several factors. The main one is the local construction cost, which may dramatically vary from one country to another. Hamon can either supply the turnkey tower or the thermal part with services like civil work design, construction steering, supervision, erection...

Hamon has designed and built more than 300 NDCT and has a wide experience even for high seismic and severe weather conditions.

Hamon is at your disposal to help you developing your project anywhere on the globe, preparing budget proposal, civil work included, and selecting the most appropriate solution for performance, heat transfer media, noise reduction, etc.

Different types of structures



Wood



Concrete



Steel



FRP

Mechanical draft cooling towers

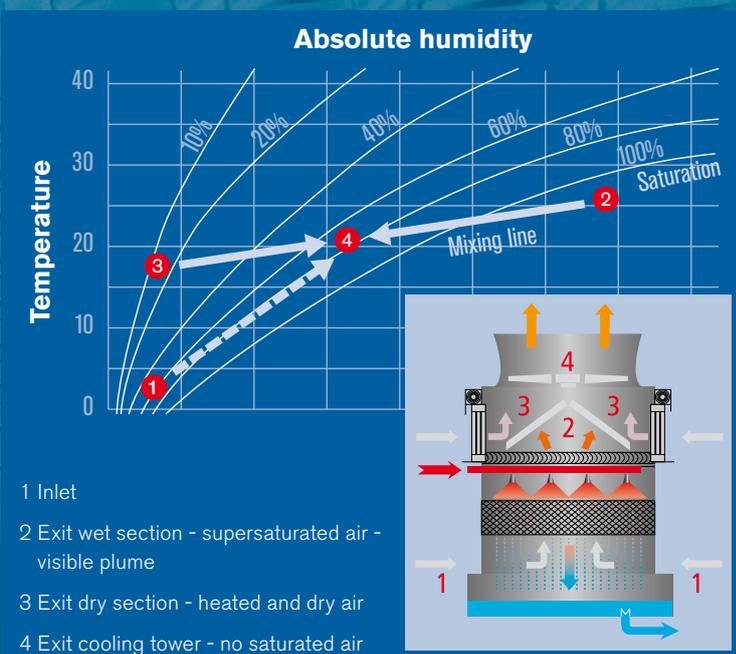
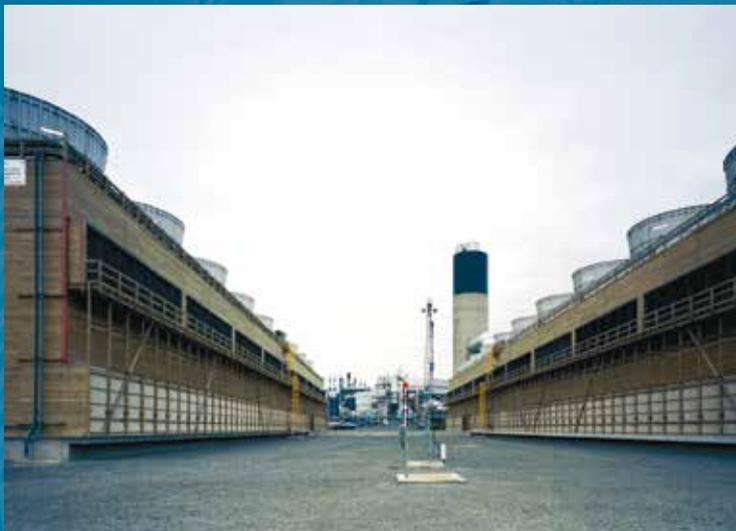


Thanks to its flexibility and cost effectiveness, the mechanical draft cooling tower (IDCT) ideally answers most cooling duties and plant requirements. With approximately 5000 references in this type of tower, Hamon has come across most of the application requirements and has developed the technology to meet them. Each customer takes full advantage of this technology data base and enjoys a product that is fine tuned and fills his requirements and budget. We build any size of IDCT with any type of structure (steel, wood, FRP, prefab concrete, cast concrete) and many heat exchange surfaces (from splash grids to high performance film). All system elements, beyond customer specific requirements guide our design:

- water quality
- air environment (chemicals, dust, ...)
- noise and plume limitation
- available plot area
- local labor costs

All our equipment is supplied with an O&M manual that clearly specifies operation, maintenance, health and safety requirements and recommendations.

For all cooling towers, we clearly advise the impact on the environment such as performance, drift loss, noise level, etc. In order to help in the prevention of legionella, our cooling tower designs follow the best practices and allow cleaning and access to the internal parts of the tower.



Principle of plume abatement

Outlet air of the wet section of the cooling tower **2** is mixed with the air heated **3** by the finned tube bundles installed in the walls above the wet section. Outlet air characteristics **4** will then be positioned on the line linking points **2** and **3**. If the line linking points **4** and **1** does not cross the 100% humidity curve, no plume will be visible.



Plume abated cooling towers



A plume abated cooling tower (PABCT) is the best available solution where local constraints are such that the presence of plume is not accepted in normal conditions (along motorways, airports, close to residential areas...).

In this area, also called hybrid or wet/dry, Hamon's technology is unrivaled.

Mechanical Draft

The first option is an IDCT offering the same flexibility, adaptability and all features listed in the previous pages. Compared to other technical solutions, it combines the following advantages:

- no plume visibility
- outstanding performance of an evaporative cooling tower
- cost attractiveness

Fan Assisted Natural Draft (Circular Hybrid)

Circular hybrid cooling towers are the best technical solutions for large heat loads and stringent plume abatement requirements. It combines the following advantages among others:

- compact arrangement / space saving
- limited height
- use of natural draft
- strong upward draft
- no washdown

Sea water

When close to the sea shore, many plants are cooled by a once-through sea water system. The investment for such a system is huge and the heat rejection back to the sea can either generate hot water recirculation and/or impact the sea ecosystem beyond acceptable levels. Replacing the once-through system by a cooling tower circuit tremendously reduces both initial investment costs and sea environmental impact of the power plant. The design of the cooling tower will take, among others, the salt concentration into account. Special care is given to construction materials (structure in concrete, protection for mechanical parts, etc.) and fill media type. Hamon sea water cooling towers are cooling millions of cubic meters in many places in the world. All design arrangements are available with sea water: NDCT, FANDCT, IDCT, PACT.



Emergency cooling tower for NPP's

The safe cooling of the nuclear island is a must because this is the ultimate heat discharge in the process.

Hamon has been closely involved in the development of emergency cooling towers and has already delivered several ones.

For new applications HAMON recommends in general Emergency Cooling Towers

- being built of small cellular modules in reinforced concrete with forced draft fans with up to 4-fold redundancy
- with water storage of minimum 2 days
- which consider the applicable hazards and are designed for extreme climate conditions
- which integrate in the housing the additional equipment like pumps, piping, valves, electrical, etc.
- almost completely built of non flammable construction materials

For existing plants, the technical solution must be developed according to the actual needs and situation.



Special applications



Noise attenuation

In order to limit the noise level, actions can be taken at three level:

- at the source with low noise fans and mechanical devices
- at the emission area with louvers, baffles, motor enclosures, special casing type
- between the noise source and the reception point with screens, walls or embankments



Cooling towers for acid solutions

Hamon has developed cooling solutions for low pH waters. Forced draft has been selected for easy access and maintenance.

District cooling

Working on broadly similar principles to district heating, district cooling delivers chilled water to buildings. For this application widely spread in the Gulf area, Hamon has already supplied more than 150 cells.

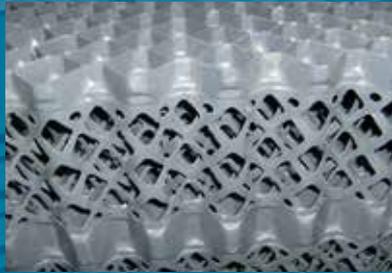


Architectural cooling towers

Cooling towers can be adapted to an architectural project for a better integration in the environment.



1



2



3



4



5



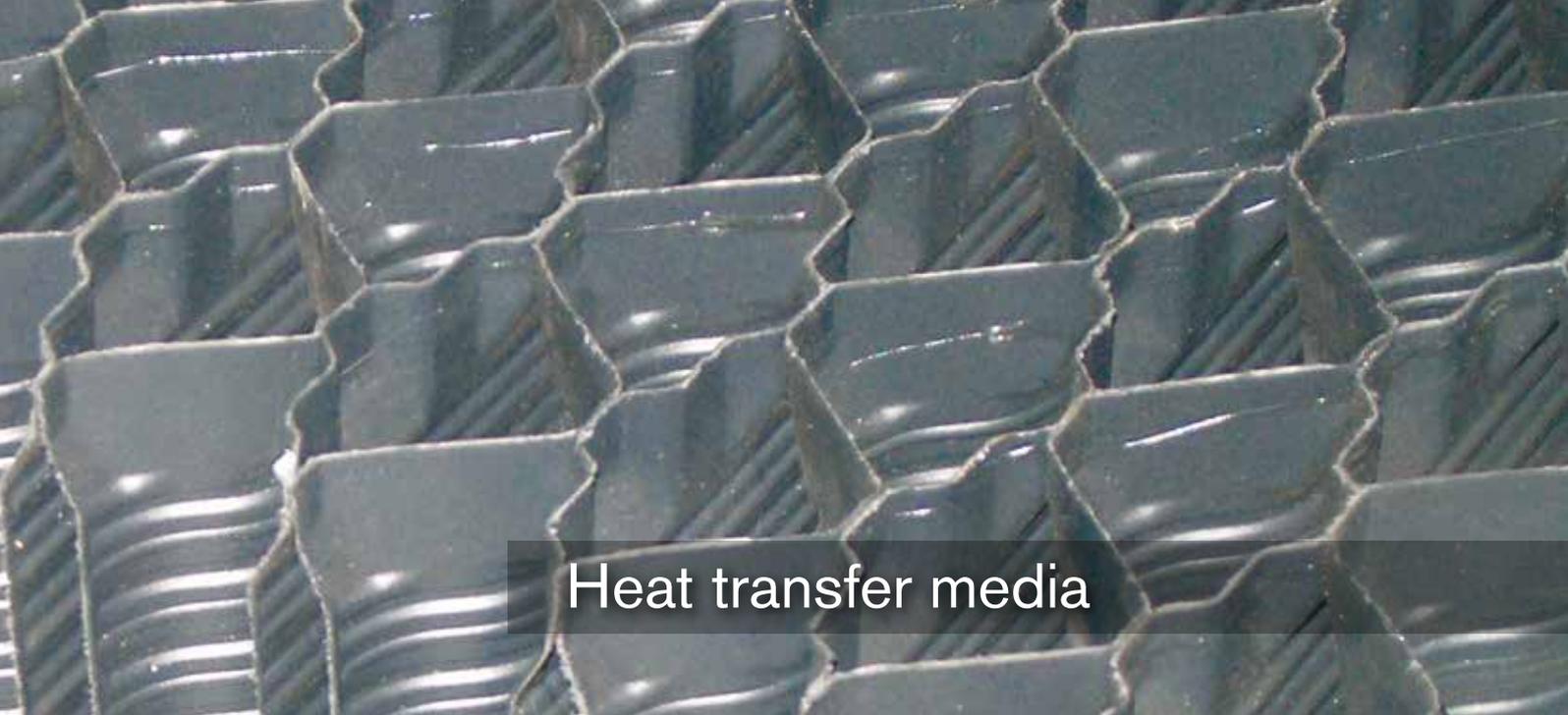
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7

Hamon has a wide range of heat transfer media suitable for:

- any industrial water
- sea water
- low pH solution
- TSE (treated sewage effluent)



Heat transfer media

The **GOLDENGRIDS ①**, the real splash fill, is the all purpose solution suitable for most water qualities, including sea water and heavily contaminated water. This heat transfer media consists of trays hung from beams located above the water distribution. The grids, their supports and spacers are made of polypropylene; the wires according to the water aggressiveness are in SS316 or in a more exotic alloy.

The **TRICKLEFILL ②** offers what is probably the highest resistance to scaling and fouling worldwide. Using Hamon's well proven technology of non-contact sheets, this vertical core fill is designed with wide sheet spacing. The sheets are smooth and incorporate a number of large square holes. The holes induce beneficial turbulence for heat transfer, whilst no fouling or scaling occurs on the supports.

The strips (resulting from perforation) make this pack act partly like a grid type. Therefore it is an excellent alternative to "mesh" or "3D grids". It can be produced PVC and PP.

The **MESH** type **③** fill combines splash and film heat exchange process with the advantages of low fouling capability of the splash fill and the good thermal efficiency of the film fill. It is well adapted to any induced or natural draft cooling tower using poor industrial water quality. Water with high concentrations of suspended fibres is not recommended.

The **COOLFEE ④** is the most advanced film fill combining low-fouling and low-scaling properties whilst retaining good thermal performance. The main application is for cooling towers using very poor water quality, in some cases even without water treatment. It is also very good for film fill cross-flow cooling towers.

The **CLEANFLOW ⑤** film fill has been qualified worldwide as the best film fill combining low fouling properties with good thermal performance. It is well adapted to any induced draft or natural draft cooling tower using poor quality industrial water. It is also suitable for other severe applications such as laminated decanting and gas cleaning.

The **CLEANFLOW PLUS ⑥** is the improved technology of the cleanflow fill by increasing its thermal performance whilst retaining its fouling resistance. It is well adapted to any induced or natural draft cooling tower using poor industrial water quality, in particular sea water.

The **COOLFILM ⑦** is probably the most thermally efficient fill worldwide. It is well adapted to any induced draft or natural draft cooling tower using normal industrial water quality.



1 Fan stack



2 Motor-fan group



3 Drift eliminators



4 Distribution

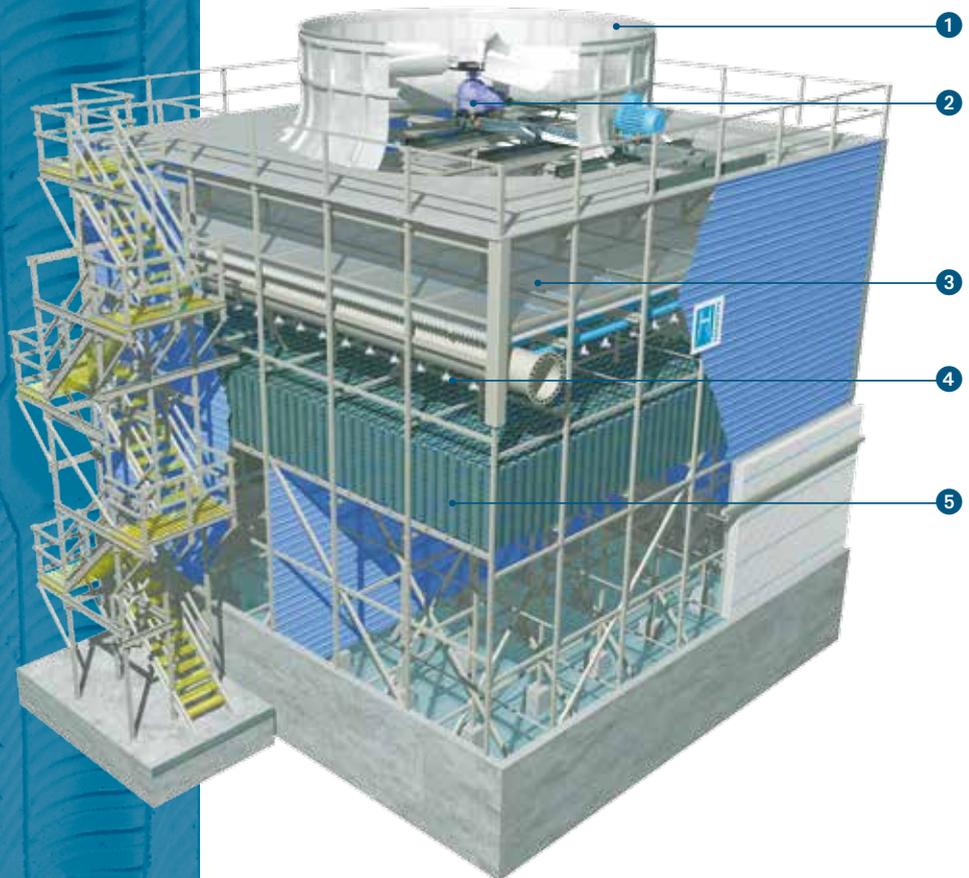


5 Heat exchange media



Spare Parts

Hamon design and manufacture their own products (fan stacks, heat exchange media, drift eliminators, distribution elements). The Spares Parts Department of Hamon Cooling Systems division will help all clients select the appropriate part for any Hamon cooling tower or from other manufacturers.





Service



Maintenance

A preventive maintenance program is essential to ensure smooth operation avoiding unexpected costly shutdowns and problems associated with legionella.

Repair - Refurbishment - Upgrade

Furthermore, for several reasons (ageing tower, increased power need, technical improvements, etc.) other works are required during the life time of the cooling tower.



Thanks to the outstanding cooling tower competence of its site teams, Hamon can consider any type of repairs, refurbishment and upgrades.

Customers recognize Hamon for its finely tuned service assuring:

- short shutdowns
- reliable diagnosis
- focus on the action needed

Our test team consisting of high level, experienced thermal Engineers can perform any test: performance, fan flow, hydraulic, noise, vibrations.

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The Hamon Group is a world player in engineering and contracting (design, installation and project management).

Its activities include the design, the manufacturing of critical components, the installation and the after-sale services of cooling systems, process heat exchangers, air pollution control (APC) systems, HRSG's and chimneys, used in power generation, oil & gas and other heavy industries like metallurgy, glass, chemicals.

Integrated Solutions for a Clean Environment

