Water for Power Generation

Crystal-clear answers to your needs.
**Competence and Experience**

Our company has been a dependable partner of the energy sector for decades. All the expertise and practical experience gained from three established water treatment companies are now available to you.

- Formation of Philipp Müller GmbH (PM) 1896
- Formation of Hager + Elsässer GmbH (H+E) 1932
- PM taken over by Degrémont (F) 1967
- Hager + Elsässer GmbH taken over by Energie- und Verfahrenstechnik GmbH (EVT) (D) 1975
- Take over of Permutit Germany (D) 1990
- EVT taken over by GEC Alstom (F) 1998
- Hager + Elsässer GmbH taken over by PM 1999
- Merger to Philipp Müller Hager + Elsässer GmbH (PMHE) 2001
- Spin-off of Degrémont’s industrial business to Ondeo Industrial Solutions (F) 2002
- Corporate name changed to Ondeo Industrial Solutions GmbH 2006
- Takeover by the Stulz Group and corporate name changed to Hager+Elsässer GmbH 2006

Irrespective of the fuel and output of a power station, we develop a customized water engineering solution for your power station. All raw water sources are feasible: Whether surface, well or sea water, cooling tower discharge or sewage treatment plant effluent are used, our treatment concept always meet the highest requirements.

Treatment of **cooling tower make-up water** is implemented by us by physical, chemical and/or membrane processes, and condensate is treated by means of cartridge filters and/or ion exchangers. The **deionization plant** for make-up water treatment is designed with ion exchangers, membrane processes or a combination of both. Own processes are used for treatment of waste water from flue gas desulfurization and wet ash removal which have proven successful in many plants.

Among our long-time customers are renowned utility companies, municipal works, industrial power station operators and general contractors. The close collaboration with our customers and the successful implementation of numerous projects in all fields of water treatment form the basis of our success. Maximum availability, highest operational dependability and a long service life of the plants at optimized cost effectiveness are important objectives for us.
Cooling Tower Make-up Water Treatment

Use

The cooling water system of a power station mainly comprises the natural draught wet cooling tower, the primary cooling water system with make-up water addition, the secondary cooling water system, as well as the make-up cooling water system.

The expanded steam is condensed to water in the condenser. The heat of condensation released is discharged to the atmosphere via the circulating primary cooling water in the cooling tower. A portion of the cooling water is blown down in order to guarantee the required cooling water quality. The evaporation and blow-down losses are made up by adding treated cooling tower make-up water.

Normally surface water is available as the raw water source. The main tasks of a cooling tower make-up water treatment plant are the reduction of suspended matter and solids and of the hardness.

Processes

- Pressure filter (multimedia filter), or ultrafiltration as an alternative
- Open filter: FILTRO-G system
- Flocculation/precipitation/sedimentation: FLOCOPAC system with sludge treatment by means of a chamber filter press or belt-type filter press
- Biocide, sulfuric acid and hardness stabilizer dosing

In order to obtain very low discharge values in a reliable and cost-effective way, we have been successfully using our FLOCOPAC-L or FLOCOPAC-LC compact flocculator for treatment of the cooling tower make-up water for many years.

In addition to the flocculation reaction, optimized by sludge recycling, and the high sedimentation rate, the FLOCOPAC-LC also offers the advantage of being insensitive to raw water quality variations. Furthermore, thanks to the compact design, up to 90% of the area can be saved which would be needed for a conventional flocculation, sedimentation and filtration plant.
State-of-the-art power station boilers need feedwater with a low salt and corrosion product content. Normally, a condensate polisher is installed to provide boiler feedwater of the required quality in the water-steam circuit of a power station.

The following equipment is used for this:
- Pressure filter (cartridge filter)
- Ion exchanger
- Adsorption (activated carbon) process

Both the circuitry and the necessary process stages and throughput are influenced by a number of boundary conditions. These include, in particular:
- Use of the power station in the base-load range, or in the medium or peak load range
- Conditioning of the water-steam circuit („alkaline” or „combined operation”)
- Use of the power station for power and/or heat generation or steam displacement
- Materials and fuel used.

Two circuits for the condensate polisher in the water-steam circuit are shown below. These also result in the necessary boundary conditions for the plant concept.

The condensate polisher is either connected directly to the main condensate stream or as a bypass. In addition to the operational dependability, the economic aspects (capital and operating cost) are thoroughly assessed within the scope of plant selection and planning. Especially in the selection and operation of ion exchangers, Hager + Elsässer can fall back on comprehensive experience and thus propose the optimum alternative from parallel flow/counterflow processes and internal or external regeneration.
Deionization plant

A further increase of the efficiency of power stations requires, among other things, higher steam parameters (pressure and temperature). Besides the appropriate materials for the turbine, ever higher requirements are placed on the steam purity and, thus, on the quality of the boiler feedwater in the power station’s water-steam circuit. Very low residual conductivities and low silicic acid concentrations must be achieved, in particular. The same also applies to organic substances.

Boiler feedwater losses in the water-steam circuit are covered by a deionization plant (boiler feed make-up water or deionized water). Hager + Elsässer provides concepts for optimized solutions for your specific requirements. These concepts are based on ion exchange, membrane, as well as physical degassing technologies and their combination. This allows deionized water of the appropriate quality to be provided even from difficult raw waters.

**Ion exchange systems** can be used in many ways for deionization. The classical process stages, such as water softening by means of a strong-acid ion exchange resin in the sodium cycle, decarbonization by means of a weak-acid ion exchange resin, deionization in combination with different resin types, as well as cascade degasifiers, membrane degasifiers or vacuum degasifiers have proven successful.

For treatment of salt-containing and organically loaded raw waters, the use of **membrane technologies** is the best solution, e.g. reverse osmosis combined with mixed-bed ion exchangers.

As a consequent further development of the membrane processes for deionization, we have developed a **modular and chemicals-free solution: ROCEDIS - the perfect combination of reverse osmosis, membrane degasification and electro-deionization**.

**Use**

**Processes**

**ROCEDIS**

**DI Plants**
Waste Water Treatment from Flue Gas Desulfurization Plants

Flue gas desulfurization (FGD) plants mainly operate on the wet absorption principle with calcium hydroxide or limestone suspension as the absorbent and reusable gypsum as the end product. Waste water is produced during this process, the composition and volume of which are influenced by many factors.

FGD waste waters are oversaturated with gypsum, may have very high solid matter concentrations, frequently have a high chloride content and contain dissolved metals. In addition, these waste waters are highly abrasive so that the selection of suitable treatment steps and appropriate materials is of great importance.

Our treatment concepts are tailored to your specific needs. Our references from numerous projects comprise the following treatment steps, depending on the task:

- Sulfite oxidation
- Removal of the gypsum oversaturation and sulfate precipitation in steps
- 2-stage flocculation/precipitation/sedimentation plant with neutralizing precipitation of the metals and their conversion into poorly soluble hydroxides, or partly into basic carbonates, as well as organosulfide precipitation in the second stage
- Sludge thickening
- Sludge dewatering

The treated waste water is discharged directly into the receiving water; the quality to be achieved in Germany being regulated in Annex 47 to the Waste Water Ordinance. FGD waste waters with higher ammonium concentrations may require secondary treatment. We have appropriate solutions for the required desorption of the ammonium with absorption system connected downstream.

<table>
<thead>
<tr>
<th>Inhaltsstoffe</th>
<th>Grenzwerte (mg/l)</th>
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</thead>
<tbody>
<tr>
<td>Abfiltrierbare Stoffe</td>
<td>30</td>
</tr>
<tr>
<td>CSB</td>
<td></td>
</tr>
<tr>
<td>-Einsatz von Branntkalk</td>
<td>80 oder TOC 26</td>
</tr>
<tr>
<td>-Einsatz von Kalkstein</td>
<td>150 oder TOC 50</td>
</tr>
<tr>
<td>Sulfat</td>
<td>2000</td>
</tr>
<tr>
<td>Sulfit</td>
<td>20</td>
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<tr>
<td>Fluorid</td>
<td>30</td>
</tr>
<tr>
<td>Giftigkeit gegenüber Fischeiern Gei</td>
<td>2 oder Chlorid+Sulfat in g/l / 3</td>
</tr>
</tbody>
</table>
The ash deposited at the boiler bottom is collected in the wet ash removal system. This solids-containing waste water is usually treated in a process waste water treatment plant. The water is first fed into a preliminary clarifier, into which further solids-containing partial waste water streams are fed as required.

In most cases, a sedimentation plant with lamella separators is suited for treatment of this type of waste water. Here, our tried-and-tested FLOCOPAC-L system is used.

Usually, a thickener is connected downstream of the sedimentation stage. In specific cases, further COD reduction may become necessary in an additional stage.

Besides reliable compliance with discharge limit values, especially a high-efficiency design with optimized chemicals demand and little space requirement is relevant for cost-effective plant operation.

The process waste waters from the wet ash removal plant are covered by Annex 31 Para. 2.4 of the Waste Water Ordinance.
“Effluent free” Water Concepts for Any Site

In arid zones, the raw water available for operation of the entire power station is frequently either sea water, brackish water or biologically treated water from municipal sewage treatment plants because the fresh water resources are exclusively reserved for drinking water production. By combining the optimum process chains, reliable treatment is possible in any case.

Due to the globally growing ecological awareness, the limit values for discharge of waste water into rivers are continually becoming more stringent. In some arid zones, no receiving water is available to receive the treated waste water. For such cases, we have developed and realized Zero Liquid Discharge concepts.

In 2006, a boiler feedwater treatment plant for an 800 MW power station in Italy had to be implemented under such difficult conditions: Effluent from a sewage treatment plant was available as the raw water source; the waste waters produced in the station, such as filter rinsing waters and boiler blow-down water, were also treated in order to obtain a Zero Liquid Discharge:

**Pretreatment**

- Flocculator to reduce the filterable substances and organic load
- Multimedia and ultrafiltration for further reduction of the organic fouling potential and chlorine dioxide dosing

**Demineralization**

- Activated carbon filtration, designed as a biofilter, to reduce the COD and DOC value and to reduce the ammonium
- Permeate-staged reverse osmosis system for demineralization
- Working mixed-bed exchanger system for fine demineralization

**Waste water treatment**

- Concentrate reverse osmosis treatment for further concentration of the waste water produced
- Batch neutralization of waste waters upstream of the evaporator stage followed by a crystallization evaporator to produce a salt slurry that can be deposited on a landfill
- Sludge treatment for thickening of the sludges produced in the flocculator
A professional customer service is indispensable in order to be able to operate process water plants in a troublefree and cost effective manner for many years. Our service offerings range from the elimination of faults up to plant management of your water plants.

Our local service engineers with their many years of experience with water treatment and process control are your dependable partners and problem solvers for day-to-day plant operation.

Hager + Elsässer offers you practice-oriented services and wall-to-wall solutions. For temporary water supply at commissioning and during shutdowns, we plan your secure supply by means of mobile containers and plants.

- Available 24 hours a day and 365 days a year
- Individual contracts for extremely short standby on call
- Analysis service by our own laboratory
- Spare parts and operating supplies management by means of outline agreements
- Warehouse in Stuttgart and local stocks of our service specialists to ensure short delivery times
- Optional deployment of other suppliers in order to maintain our competitiveness in terms of price and delivery time
- Service by local engineers, or plant management on site
- Online monitoring of water plants.

Within the scope of audits, we assess all aspects of water treatment and use for the purposes of potential savings, and we evaluate the state of the plants and the process technology used.

We assume responsibility for continuous improvement, optimization and conservation of the value of your plants by means of a sophisticated service concept under plant management models.

**Objective**

**Offerings**

**Optimization**
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