Maarky.com

MAARKY THERMAL SYSTEMS

Innovate & Implement™

Maarky Thermal Systems Inc.

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- Steam Surface Condensers
- Feedwater Heaters
- Heat Exchangers
- Solar Heat Exchangers
- Site Technical Services
- Consulting Services
- Fabrication

Maarky Thermal Systems

Maarky Thermal Systems, a marquis asset of the global power industry, provides state of the art heat transfer equipment and services to power plants worldwide. These include steam surface condensers, feedwater heaters and heat exchangers as well as site and consulting services. Over 100,000 MW of power plants operating worldwide are equipped with heat transfer components designed by Maarky engineers.

Maarky Thermal Systems provides state of the art heat transfer equipment and services to power plants worldwide. Equipment designed by Maarky engineers has been hailed as the standard for optimal and reliable performance.

The corporate slogan of "**Innovate & Implement**" is embedded in every facet of Maarky's culture. Pursuit of innovations and improvement in all spheres of business activity such as sales and marketing, equipment design, fabrication, project management, quality assurance, after sales service and customer satisfaction is a part of everyday effort at Maarky.

Implementations of these innovations, however minor they might be, allow Maarky to be more efficient, competitive, and better aligned to meet the growing and demanding needs of the global power industry.

Maarky offers steam surface condensers, feedwater heaters, and heat exchangers for all types of power plants. Solar power plant heat exchangers such as steam generators, preheaters, superheaters, reheaters and molten salt heat exchangers are Maarky's specialty. Maarky heat transfer products are designed to offer reliable performance and are manufactured to the highest standards of quality.

Maarky engineers have designed hundreds of steam surface condensers and feedwater heaters operating in power plants worldwide with generating capacity in excess of 100,000 MW. Innovative and optimized designs, in addition to superior product knowledge, ensure that the heat transfer components perform to the highest standards of efficiency. Robust designs combined with proper safety features permit optimal performance during normal and transient operation. Skilled craftsmen with the state of the art machinery and tools guarantee that Maarky products are fabricated to highest standards of quality.

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Comprehending the evolving needs of the power industry and recognizing the drawbacks of the existing know-how enables Maarky engineers to craft innovative technologies to bridge the gap. Publications of these bridging concepts have encouraged the engineering community to move in new directions with relevant revisions to applicable codes and standards. The initiative of Maarky engineers to expand the prevailing technologies to new horizons has been applauded by the engineering community.

Watercooled Condensers

Maarky offers steam surface condensers for the following genre of power plants:

- Coal Fired
- Gas Fired (Combined Cycle)
- Cogeneration
- Industrial
- Waste to Energy
- Nuclear
- Solar

A steam surface condenser is a critical component of a power plant. The generating capacity of a power plant is dependent on the performance of the steam surface condenser. Maarky condensers are designed to provide the lowest backpressure which, in turn, maximizes the output from the power plant.

Steam surface condensers are offered for power plants ranging in output from 10 MW to 1000 MW and in the following configurations:

- Cylindrical, Inverted “U”, or Rectangular
- Axial or Down Exhaust
- Single or Multiple-Pressure
- Single or Multiple-Shell
- Divided or Non-Divided Waterbox
- One Pass or Multi-Pass

Each condenser is designed in accordance with the client’s specifications to offer the highest thermal efficiency and structural integrity. The thermal, hydraulic and mechanical aspects of the condenser are designed using state-of-the-art-technology. The design is in accordance with the following codes and standards:

- Heat Exchange Institute (HEI)
- American Society of Mechanical Engineers (ASME)
- Electric Power Research Institute (EPRI)

Each component of the condenser is designed to provide superior performance, simplified fabrication and easy installation. The robust and creative designs offer excellent performance when operated at the design point as well as off design conditions.

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Trouble-free performance in turbine bypass operation is of paramount importance in a combined cycle plant. With the steam turbine out of service, the high pressure and high temperature steam discharged from the heat recovery steam generator (HRSG) is directed to a pressure reducing desuperheating (PRD) valve wherein the pressure and temperature of the steam is reduced to desired values. The bypass steam from the PRD valve is admitted directly into the condenser. The above mode of operation is commonly referred to as bypass operation.

Maarky condensers are designed to operate reliably in bypass operation. The range of steam pressures and temperatures admitted into the condenser is carefully established to avoid "wet steam" condition. The bypass headers are designed and strategically located to avoid damage to tubes and condenser internals from impinging steam. Proper interface between the PRD valve supplier, the architect engineer and the condenser designer is of prime importance. The scope of supply for each party is clearly defined to avoid errors due to miscommunication and to ensure reliable operation.

Steam flows in a condenser at normal, startup and transient conditions are complex in nature. These complex thermal, hydraulic, and structural interactions are predicted by using state of the art Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA) tools such as FLUENT and ANSYS.

Maarky steam surface condensers are designed and fabricated in the largest possible sections to minimize field erection. All components are match-marked in the factory to ensure proper alignment. Any misalignment is corrected in the factory prior to shipment. Adequate provisions are included to facilitate lifting and maneuvering the sub-assemblies in the field. Accurate alignment and proper lifting arrangements permit erection of the components at the lowest cost and shortest schedule.

Optimal performance of a condenser is achieved with the proper design and selection of a wide array of auxiliary systems. The evacuation package is a critical auxiliary item. Continuous evacuation of non-condensable gases is essential for proper condensation of steam in a condenser. Steam jet air ejectors or liquid ring vacuum pump systems are the primary means of evacuating non-condensable gases from a condenser. Another important auxiliary item is the waterbox priming system, which facilitates the flow of the circulating water through the tube side of the condenser in a once-through cooling system. Other auxiliary systems that enhance the performance of the condenser are the condensate pump system, cathodic protection systems, continuous ball cleaning system, pressure reducing desuperheating valves, expansion joints, and a variety of instrumentation.

Maarky offers the following auxiliary items along with the steam surface condenser:

- Steam Jet Air Ejector System
- Liquid Ring Vacuum Pump Systems
- Waterbox Priming Systems
- Continuous Ball Tube Cleaning Systems
- Condensate Pump Systems
- Waterbox Cathodic Protection Systems
- Deaeration Systems (for large quantities of makeup water)
- Condenser to Turbine Expansion Joints

The auxiliary systems are carefully designed to supplement the performance of the condenser at all modes of operation and are procured from suppliers with proven record of quality and reliability.

Bypass Condensers

Some of the challenges encountered in the design and operation of a bypass condenser are:

- High tubeside flow rates
- High temperature differences between shellside and tubeside fluids
- Large shell diameters and extremely small tube lengths
- Large operational transients

In an industrial or waste to energy plant, upon turbine trip, the high pressure steam from the steam generator is attemperated in a pressure reducing desuperheating (PRD) valve and then condensed in the main condenser. In certain instances, the steam from the PRD valve is condensed in a separate heat exchanger often called the bypass condenser.

The design and construction of bypass condensers is similar to that of steam surface condensers and feedwater heaters. The circulating water from the cooling tower flowing through the tubeside imparts the condenser characteristics, while the condensation and subcooling of the condensate on the shellside impose the feedwater heater characteristics.

A clear understanding of the principles of design of steam surface condensers and feedwater heaters is mandatory for designing a reliable and robust bypass condenser.

Bypass condensers can be designed for a wide range of operating scenarios such as high pressure, low pressure, condensing only, condensing and subcooling, horizontal, vertical, constant pressure or constant level. Performance at off design conditions can impact the hardware design and therefore must be carefully considered prior to finalizing the mechanical design. Maarky bypass condensers are designed to offer reliable performance at all specified operating scenarios.

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Feedwater Heaters

Regenerative heating of feedwater is essential to enhancing the efficiency of a power cycle. The feedwater is heated to the maximum permissible extent in a feedwater heater using controlled or uncontrolled extraction from the steam turbine.

Channel up and channel down heaters pose unique design challenges. The number of tubes and the lengths of the desuperheating and subcooling zones are carefully established to enable all zones to perform satisfactorily and to eliminate problems with misdirected flows.

The shell internals are equipped with adequate clearances to ensure proper distribution of steam throughout the entire length of the heater. The number of support plates and baffle plates is calculated such that steam velocities in the heater shell during normal and transient conditions are within acceptable limits and flow induced vibration is avoided.

Three zone feedwater heaters are equipped with a high efficiency desuperheating-zone. The cross-flow velocity is optimized to offer the highest heat transfer coefficient, minimal shellside pressure drop and zero incidence of flow-induced vibration. The subcooling zone is designed to offer the highest heat transfer coefficient, lowest shellside pressure drop and to eliminate condensate reheating and flashing.

Maarky provides high, intermediate and low pressure feedwater heaters to the power industry for steam turbine applications ranging from 10 MW to 1,000 MW. The heaters can be designed for a variety of configurations including, but not limited to,:

- Horizontal or vertical
- Channel up or channel down
- One, two or three zone
- Duplex
- Channel closure: hemi head, pressure seal or welded diaphragm-bolted cover

Heat Exchangers

Power plants use a variety of heat exchangers to transfer heat between various fluids. The heat exchanger configuration is dictated by the thermal and hydraulic application. Maarky heat exchangers are designed using the Heat Transfer Research Institute (HTRI) programs and in-house design programs.

Each component of the heat exchanger is carefully designed to offer the highest heat transfer coefficient and the lowest pressure drop. Adequate flow areas are maintained in all sections of the heat exchanger to eliminate the detrimental effects of flow inducted vibration and erosion.

Heat exchangers for unique applications with non-standard configurations, high temperature, high pressure, high cyclic service, and unusual fluid properties and materials are Maarky's specialty. Years of experience in design, fabrication, operation, and trouble-shooting a wide genre of heat transfer equipment permit Maarky engineers to offer proven yet innovative solutions to achieve the unique requirements for performance and structural integrity. Complex thermal, hydraulic and mechanical designs beyond the reach of conventional approach are performed using the advanced analytical tools such as Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD).

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Solar Power Plant Heat Exchangers

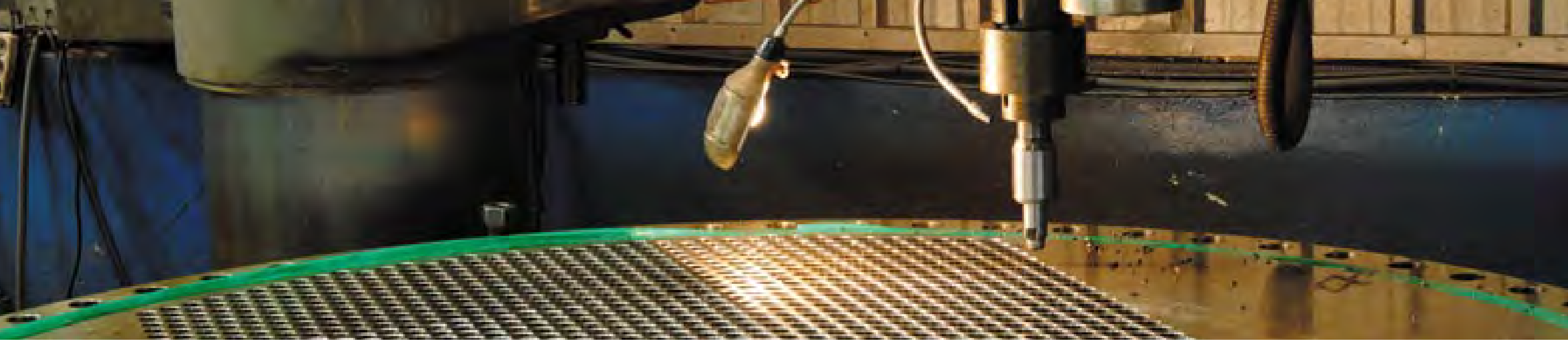
The pressing need to lower emissions from fossil power plants has focused worldwide attention on renewable sources of energy such as solar, wind, geothermal and biomass. Concentrated Solar Power (CSP) plants have emerged as strong contenders for alternate sources of energy. Rapid advances in mirror technology have slowly but steadily narrowed the gap in the capital investment between solar power plants and its peers, making solar power plants more economically viable for power generation.

In a parabolic mirror solar power plant (trough design), the heat transfer fluid (HTF) is heated to elevated temperatures using the energy from the sun. The thermal energy in the HTF is used to convert water to superheated steam in a series of heat exchangers namely the preheater, steam generator and the superheater. The thermal energy in the HTF is also used to heat the steam exiting the high-pressure steam turbine in a reheater. The preheater, steam generator, superheater and the reheater are commonly referred to as the solar power plant heat exchangers.

In a number of applications, molten salt heat exchangers are used to facilitate power generation at night (thermal storage). During daylight, molten salt is heated to elevated temperatures using the energy from the sun (or the HTF) and then stored in large vessels. At night, the thermal energy in the molten salt is transferred to the heat transfer fluid (HTF) in molten salt heat exchangers. The heat from the HTF is then used to heat water to superheated steam in the preheater, steam generator and the superheater and to heat the steam exiting the HP turbine in the reheater.

Some of the challenges encountered in the design of the solar power plant heat exchangers are cyclic operation, rapid startup and shutdowns, high pressure and high temperature applications, minimal shellside or tubeside pressure drop, and unconventional thermophysical properties of the heat transfer fluid. Each component of a Maarky heat exchanger is designed to offer optimal performance at all modes of operation. The thermal and hydraulic designs are configured from state of the art technology, proprietary concepts, and experience in design, fabrication, startup, and trouble shooting of heat exchangers in critical service. Each pressure and non-pressure part is carefully designed to withstand the specified normal and transient loads.

For solar power plants, Maarky also offers standard power cycle equipment such as steam surface condenser and feedwater heaters. Other components such as deaerators, condensate pump skids, and boiler feed pumps are offered through our suppliers.



Site Technical & Consulting Services

Site Technical Services

Expeditious erection and commissioning are essential for lowering the overall cost of a power plant. The EPC contractors have the challenging task of engineering, procuring and installing thousands of power plant components and making them work in unison to generate electricity. Steam surface condensers and their associated auxiliary systems, feedwater heaters and heat exchangers are critical components of a power plant. These components have to be designed, fabricated, installed and operated without any variances in order to obtain the maximum output from the power plant. Minor deviations or non-conformances can jeopardize the performance of the entire power plant.

Delays in erection or commissioning may originate from miscommunication or errors in specifications, design, fabrication, erection, startup or commissioning. In such an event it is imperative to determine the root cause of the problem and establish and implement a corrective action expeditiously to minimize the delay.

Maarky engineers, well-versed in the thermal, mechanical, hydraulic design and fabrication of steam surface condensers, feedwater heaters and heat exchangers, are trained to zero in on the problems affecting the component. Drawing from a vast memory bank of “Problem/Root Cause/Fix,” experienced Maarky engineers with thorough product knowledge are able to offer optimal and appropriate solutions on an expedited basis.

Consulting Service

Steam surface condensers and associated auxiliary systems, feedwater heaters and heat exchangers are complex power plant components that have to be carefully designed, fabricated and integrated into the power cycle. These components have to “talk” to other interconnected equipment and function as a single entity. Deviations in operating conditions, operating sequence, control philosophy or degradation in equipment due to age, can have severe impact on the output and the efficiency of the power plant.

In a steam surface condenser plugged tubes, erosion of tubes, degradation of air removal system, air in leakage, improper deaeration of condensate and improper operation of bypass system among others can have a major impact on the performance of the power plant. In a feedwater heater plugged or eroded tubes, improper level control, flashing or reheating of condensate in subcooling zone, wet wall conditions in desuperheating zone or flow induced vibration can affect the plant heat rate.

Maarky engineers are trained to evaluate and analyze the impact of various problems on equipment performance. Extensive product knowledge combined with decades of experience in power plant equipment design, fabrication and operation permits Maarky engineers to debug the problem and offer appropriate solutions to correct the problem.

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Fabrication

Maarky heat transfer components and systems are fabricated in manufacturing facilities in North America and Asia. With decades of experience in custom fabrication, all relevant certifications, state-of-the-art machining centers and a sound quality assurance program, skilled and dedicated manufacturing specialists bring Maarky designs to life.

Upon receipt of fabrication drawings and instructions, skilled artisans cut, bend, grind, machine, drill, and weld the components into their final forms. The resulting product, in full compliance with Maarky's specifications and highest standards of quality and precision, is ready to be shipped and installed in the power plant to serve its intended purpose.

The manufacturing facilities have the following resources as a minimum:

MANUFACTURING RESOURCES:

Manufacturing:	100,000 square feet
Laydown:	500,000 square feet
Cranes:	Over 100 tons (Total)
Turning rolls:	Over 100 tons
Shipping Dimensions:	17' x 17' x 60'
Shipping Weight:	100 tons (each piece)
Shipping Methods:	Road, Rail, and Marine

CERTIFICATIONS:

- ASME "S" Stamp (Power Boilers)
- ASME "U" Stamp (Unfired Pressure Vessels)
- ASME B31.1, B31.3 and B31.5 (Piping Codes)
- ISO 9001: 2008

WELDING:

- Over 250 Approved ASME Welding Procedures
- More Than 50 Welding Stations
- Sub Arc Welding Station Tower
- Orbital Robot GTAW Process (Tube to Tubesheet Welding)

WELD QUALIFIED FOR THE FOLLOWING MATERIALS:

- Carbon Steel
- Stainless Steel 304,304H,316L, 317L, 317LMN
- Sea Cure, AL6XN, Duplex 2205
- Hastelloy, Titanium
- Dissimilar Materials

Please contact sales@maarky.com for detailed information on the manufacturing facilities.

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