SPX®

Indirect Natural Draft Dry Cooling

A History of Leadership in Cooling Technologies

Since 1883, the world renowned companies that formed SPX Cooling Technologies have been leaders in developing innovative solutions for cooling systems.

By combining the experience and resources of some of the most successful companies in the industry, SPX Cooling Technologies continues to deliver innovative products and cooling solutions for the 21st century. With hundreds of installations and partners/subsidiaries on all continents, SPX Cooling Technologies maintains a global reputation of excellence in power generation and industrial markets.

460 MW Combined Cycle Power Plant
Bruges, Belgium

Dry Cooling

Diminished water resources and increased water pollution concerns have led to the explosive growth of dry cooling worldwide.

The *major benefits* of dry cooling include:

- Nearly zero water use and discharge for the power plant
- Flexibility in power plant site selection

SPX offers several types of dry cooling equipment. The most common dry technology is the mechanical draft Air Cooled Condenser (ACC). Its natural draft counterpart is the Indirect Dry Cooling Tower (IDCT).

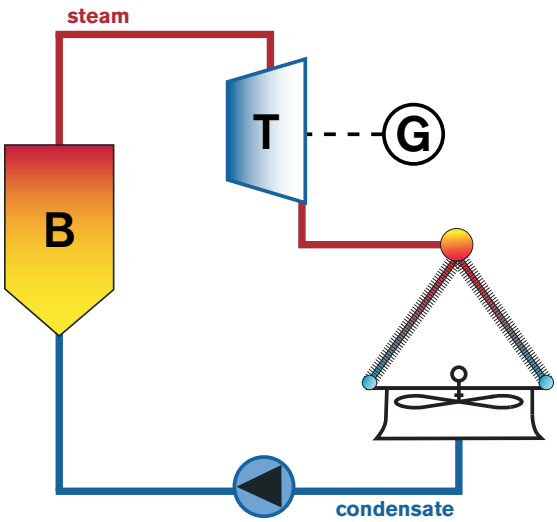
Mechanical Draft Air Cooled Condenser (ACC)

The air cooled condenser is the most popular option in dry cooling representing more than 90% of the dry cooling market. Since the mid-80s, SPX has installed hundreds of ACCs worldwide.

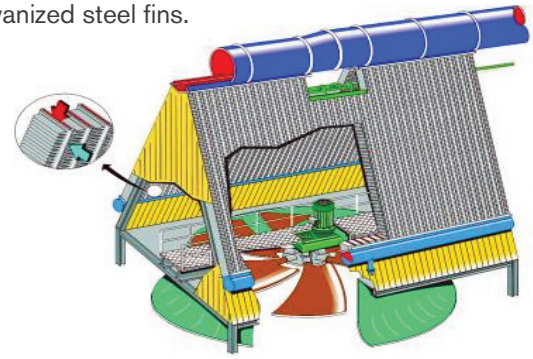
The steam flowing from the turbine is distributed to the fin tube heat exchangers arranged in an A-frame. Air is blown across the fin tubes by forced-draft axial fans. Steam is condensed within the fin tubes and condensate is collected and pumped to the boiler.

The finned tube is the key component of the ACC ensuring the performance and longevity of the equipment. Two types of high quality tubes are available:

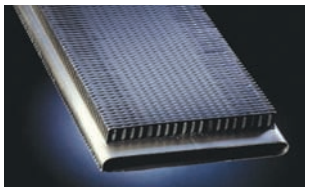
- Single-Row Condenser finned tube–SRC® elongated, flat tube with brazed aluminum fins.
- Multi-Row Condenser finned tube–MRC oval tube with hot dip galvanized steel fins.



ACC Plant cycle



Typical ACC module



SRC finned tube

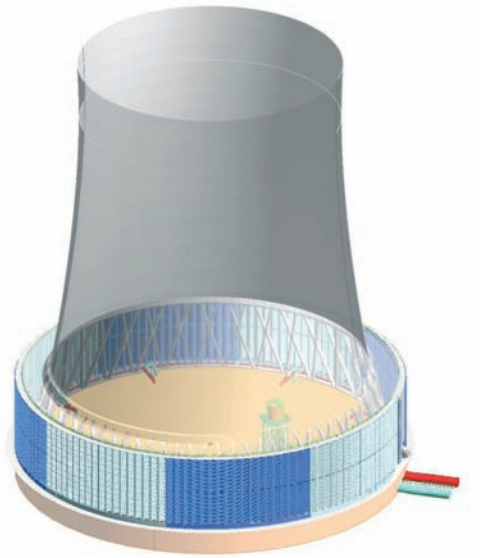
MRC finned tube

Natural Draft Indirect Dry Cooling Tower (IDCT)

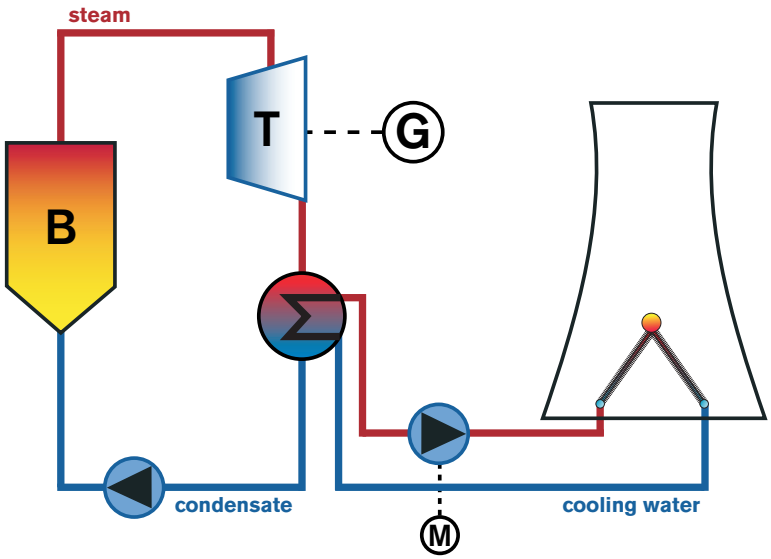
Indirect dry cooling systems have been used for over 50 years for various applications in the power industry. Active for more than three decades in the indirect dry cooling market, SPX has supplied the largest indirect system presently in operation in the world.

Steam flowing from the turbine is condensed by cold cooling water in either a surface condenser or in a jet condenser. The heated cooling water is then pumped to the heat exchangers arranged vertically around the concrete tower. Airflow across the heat exchangers is created by the natural draft cooling tower.

Like the ACC, the finned tube is the key component. The indirect dry cooling tower is equipped with MRC hot dip galvanized carbon steel oval tubes and fins providing outstanding reliability and performance.



New generation of SPX Indirect Dry Cooling Tower
Heat exchangers arranged Vertically around the tower



Plant cycle with traditional IDCT and surface condenser

Why Select an Indirect Dry Cooling Tower System?

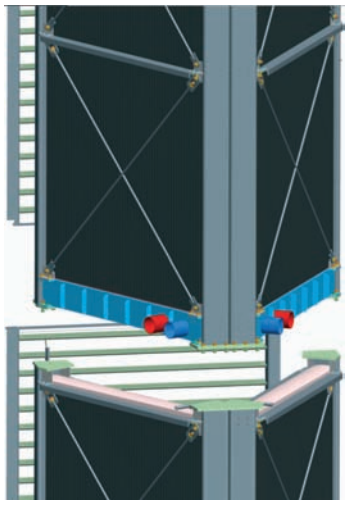
Despite requiring a large concrete shell, the natural draft IDCT offers the following features:

- Reduced auxiliary power
- Few rotating parts translates into low maintenance and high availability
- Hot air recirculation avoided by the tall concrete shell
- Option to install the Flue Gas Desulfurization (FGD) unit inside the tower
- Quiet operation

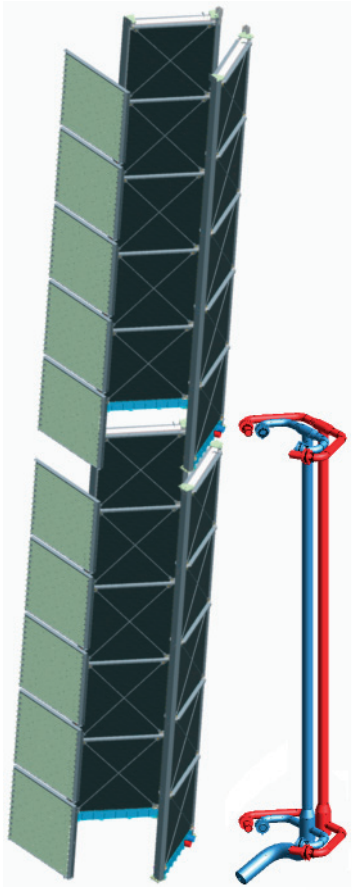
Natural Draft IDCT

Cooling Elements

- The finned tubes bundles are arranged in delta shape
- The delta shape incorporates louvers on the front and finned tube heat exchangers on the back sides
- The finned tube bundles are arranged vertically around the perimeter of the tower
- Bundles are arranged vertically in two levels
- This MegaDelta™ (patent pending) arrangement drastically reduces waterside pressure drop

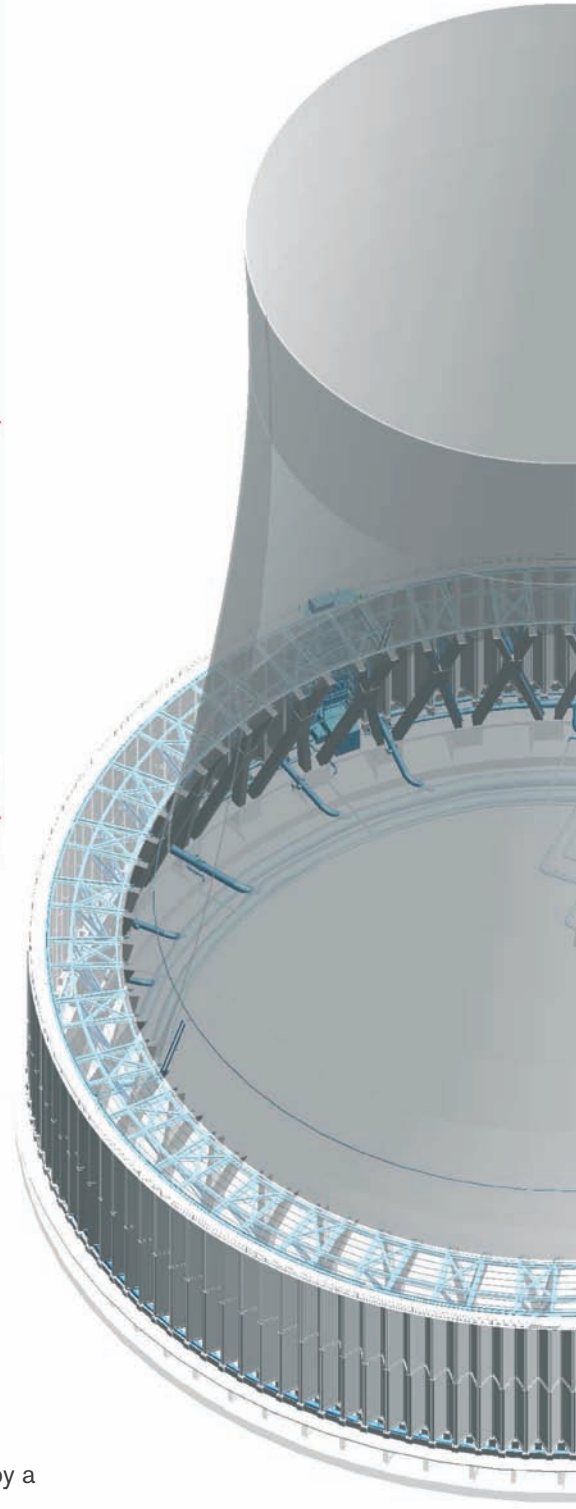


Connections between the two levels of the MegaDelta



MegaDelta with louvers and piping

MRC hot dip galvanized finned tube



Louver System

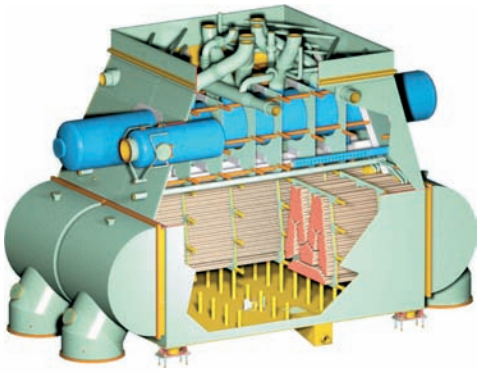
In cold climates, an automatic louver system is installed for freezing protection.

Finned Tubes

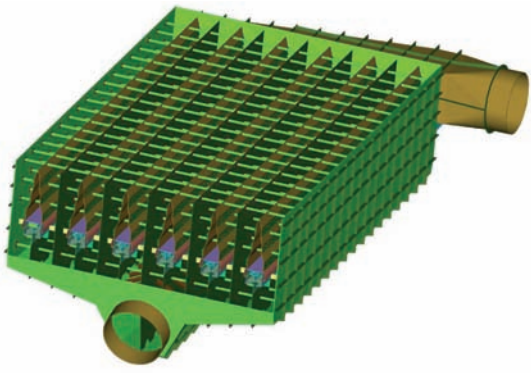
- MRC tubes are made of carbon steel fins wound around oval tubes (see picture). The whole set is hot dip galvanized after fabrication.
- The finned tubes are arranged in four rows/two passes and are supported by a robust hot dip galvanized structure.
- The finned tubes are welded to the water distribution headers.

Condenser

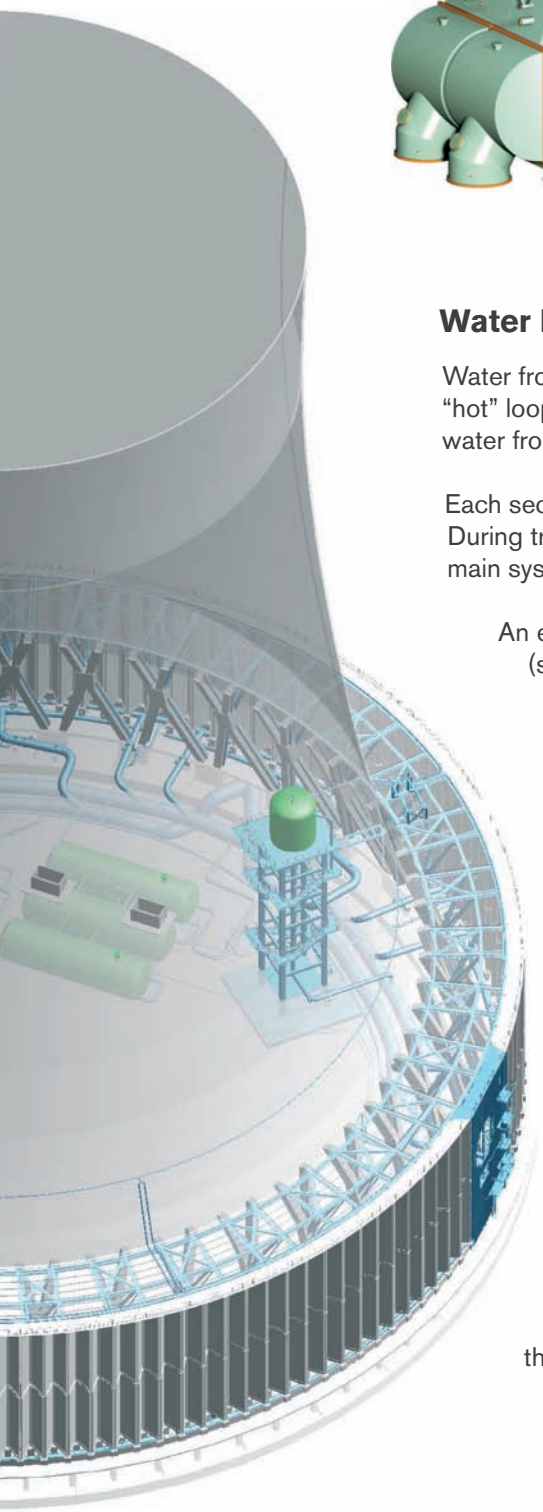
The IDCT system is suitable for either a surface or jet condenser



SPX Surface Condenser



SPX Jet Condenser



Water Distribution System

Water from/to the condenser enters the tower through two main distribution rings. The "hot" loop conveys the hot water to the sector whereas the "cold" loop collects the cold water from the sector. They are interconnected to allow bypass operation.

Each sector has an individual water distribution system connected to the main loops. During transient operation or maintenance periods, each sector can be isolated from the main system. Special piping is also incorporated for draining, filling and air venting.

An elevated filling tank and buried drain tanks are mandatory for special operations (start-up, shutdown, emergency measures, etc.)

The water circulation is handled by pumps installed outside of the tower. If a jet condenser is selected, a recovery hydro-turbine should be added to decrease the auxiliary power.

Fin Tubes Cleaning System

- The cleaning system is made of a light aluminum carriage manually or electrically moved around the tower.
- The water consumed during cleaning is collected at the bottom level of the deltas.

Flue Gas Desulfurization Option

There is enough space inside the tower to install a FGD unit. Due to the natural draft created by the large concrete shell, only a short chimney is necessary to lift the flue gas.

IDCT Unique Features

Low Parasitic Losses

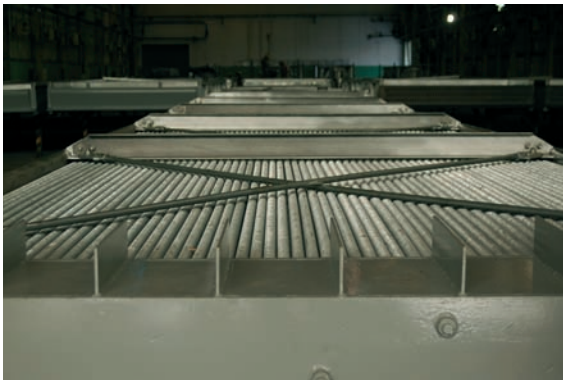
SPX's MegaDelta technology drastically reduces the water-side pressure drop and consequently the pumping power compared to one-level designs.

Excellent Heat Transfer Performances

- Finned tubes are oval shaped reducing air resistance and maximizing heat transfer
- The four rows of finned tubes are arranged in two passes hence benefitting from the thermal efficiency of the cross-counter flow arrangement

Inside view of MegaDelta during lift

Carbon steel bare tubes waiting to be finned



Finned tubes being welded to the tube sheet

Strong Resistance to Ambient Conditions

- Hot dip galvanized air-side surfaces offer excellent corrosion protection
- Like other parts in the condensate system, carbon steel tubes are utilized, avoiding the water treatment challenges associated with the use of aluminum tubes.
- Thermally optimal oval fin tube profile reduces susceptibility to fouling and promotes cleaning effectiveness.
- Oval tube shape mitigates the risk of damage in the event of freezing.

Robust, Low Maintenance Fin Tubes

- SPX's seal welded tube-to-tube sheet connection greatly mitigates leak risk and eliminates the need to routinely replace O-ring seals.
- Carbon steel, tension wound fin, hot dip galvanized to carbon steel tube, provides a full and durable bond between the fin and the tube.
- Sturdy carbon steel fins allow for enhanced high pressure water jet cleaning, while mitigating the risk of damage to the fins.

Fast and Efficient Assembly and Installation

- The MegaDelta, consisting of up to four heat exchanger bundles, can be assembled at grade then lifted and set into place as a one piece assembly.

Tube bundles assembled into a Delta shape

A 25m high MegaDelta being lifted

10 GW of Indirect Dry Cooling

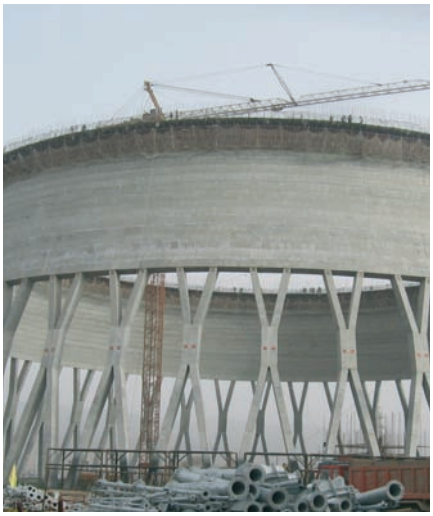
6 x 690 MW Coal Fired Power Plant
Kendal, South Africa – 1992

Coal Fired Power Plant – Auxiliary Cooling System
Tongchuan, China – 2006

2 x 660 MW Coal Fired Power Plant with FGD
Qinling, China – 2011

Nuclear Power Plant
Schmehausen, Germany – 1977

200 MW Coal Fired Power Plant
Grootvlei, South Africa – 1978



2 x 660 MW Coal Fired Power Plant
Zuoquan, China – 2012

Dry Cooling - Global Network

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