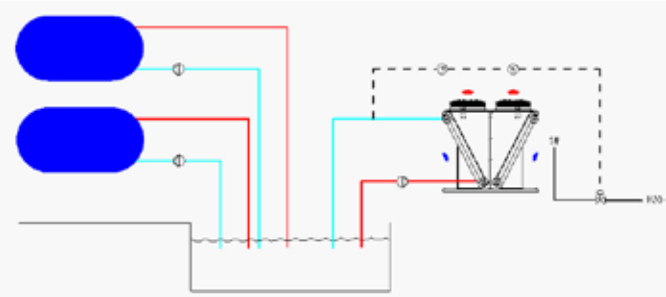
Cooling high-vacuum electrical furnaces

Manufactury industry, Italy **Case story**

A major manufacturing company in northern Italy uses two high-vacuum electrical furnaces in its brazing processes. To provide the necessary cooling for the furnaces, the factory's technical department designed cooling units according to instructions from the furnace supplier. For assistance in heat transfer, collaboration was initiated with Alfa Laval.

Task and description of the application
Furnace function is based on electrical resistance. The brazing area is completely covered with a layer of graphite and a water jacket keeps this graphite layer warm. At a predefined temperature, the water is circulated with pumps to remove the heat.

The entire plant is shown in the following block below: a pump moves a fixed quantity of water from an underground tank through the furnace jackets, while another pump moves water from the same tank through the dry cooler.



Heat transfer alternatives
The thermal capacity, the delta temperature needed and the air temperature during the year in this part of Italy were all taken into consideration, two different alternatives were studied by the project engineers.

One of the key objectives set by management was to reduce required maintenance as much as possible. In particular, there were important considerations regarding the cooling towers:

– Water quality must be frequently checked to avoid salt deposits, corrosion and legionella.

Two furnaces like this are cooled by an Alfa Laval dry cooler

– Every 3–6 months, all parts of the cooling tower must be cleaned (about one working day for two persons).

– When the cooling tower is not used for more than two months, it must be cleaned and all water in the reservoir must be drained (about one working day for two persons).

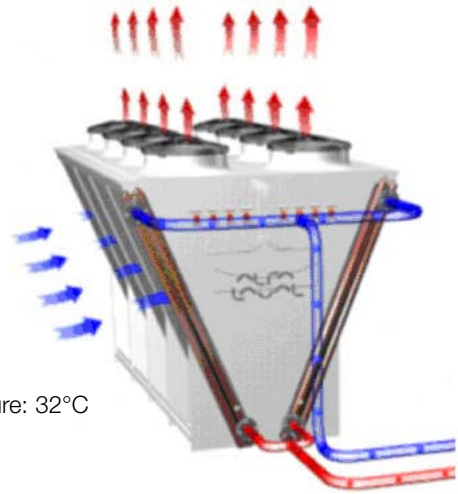
The Alfa Laval proposal to use a dry cooler was quickly accepted, mainly because of the following benefits:

– Less maintenance
– No water consumption
– No risk of legionella
– Easy capacity control

Dry coolers need less maintenance and less operating costs compared to cooling towers

Operation

The dry cooler is a DCVS 904 D and it runs 24 hours a day, 5 days a week. It is equipped with an electrical cabinet and a water spray device. This device is particularly useful when the air temperature reaches 32°C and the heat transfer capacity has to be increased through evaporative cooling of incoming air. It consists of a pipe system with several nozzles that inject a fine spray of water into the air being drawn past the coils. The water spray device can achieve a temperature drop of about 4-7°C (depending on relative humidity and air velocity). At this plant, a temperature regulator turns on spraying when the dry cooler's outlet temperature reaches 35°C, and turns off the fans at –5°C.



Technical data

Capacity: 470 kW
Air design temperature: 32°C
Fluid flow: 60 m3/h
T in/out: 43/33°C

Key facts about V-type dry cooler

Heat exchanger

- Optimized V-type design provides large capacity with compact size.
- Innovative heat exchanger, new fin corrugation, combined with smooth tubes.
- Heat exchanger constructed of aluminum fins and copper tubes with nominal diameter of 1/2".
- Double connections provide capability for two completely independent heat exchangers.

Fan motors

- High-efficiency fans with low power consumption are used.
- The external rotor motors are manufactured in accordance with VDE 0530/12.84, protection class IP 54.
- Thermal switches provide reliable protection against thermal overload.
- New bell mouths optimize performance of fan motors and minimize noise.

Frame and casework

- Casework made with galvanized steel sheets, cataphoresis-treated and painted (RAL 9002).
- Full accessibility to the unit with fan motor bell mouths easily removable.

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