Valve Cooling System
System Description

- The Valve Cooling System is a single closed loop deionised water system.
- Heat transfer to the ambient is provided by dry coolers.
- The Valve Cooling System is for one pole and works independent of other cooling and air conditioning systems.
- Spray water will be used if the water temperature rises above controller set point value.
<table>
<thead>
<tr>
<th></th>
<th>Kolar Station</th>
<th>Talcher Station</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Dry Bulb One Hour Average</strong></td>
<td>45°C</td>
<td>50°C</td>
</tr>
<tr>
<td><strong>Minimum Dry Bulb One Hour Average</strong></td>
<td>2°C</td>
<td>0°C</td>
</tr>
<tr>
<td><strong>Total Cooling Capacity</strong></td>
<td>4340kW</td>
<td>4053kW</td>
</tr>
<tr>
<td><strong>Water flow</strong></td>
<td>4140l/min</td>
<td>4350l/min</td>
</tr>
<tr>
<td><strong>Water Inlet Temperature MAX</strong></td>
<td>50°C</td>
<td>50°C</td>
</tr>
<tr>
<td><strong>Water Outlet Temperature Average</strong></td>
<td>62°C</td>
<td>62°C</td>
</tr>
<tr>
<td><strong>Water Conductivity</strong></td>
<td>&lt;0.5μS/cm</td>
<td>&lt;0.5μS/cm</td>
</tr>
<tr>
<td><strong>Redundant Circulating Pumps</strong></td>
<td>One of two</td>
<td>One of two</td>
</tr>
<tr>
<td><strong>Spray Water Storage for</strong></td>
<td>24hrs</td>
<td>24hrs</td>
</tr>
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Flow Diagram
Valve cooling main pump

- Two centrifugal circulating pumps
- One pump - operating
  Other pump - standby
- Periodical automatic pump changeover.
- Changeover to the standby pump takes place in case of failure of the operating pump
- Capacity of
  - Motor – 45KW
  - Pump – 265Cu.m/Hr
In the main water line to the thyristor valves locates a 50 micron filter.

The filter is used for start up and cleaning and later on for safety, that no particle greater than 50 micron can enter the thyristor valves.
Valve cooling - main filter

- Main filter consists of group of filter cartridges as shown in the figure
- If the filter gets choked for any reason, differential pressure will be sensed and this warns for maintenance
Valve cooling – make up water tank

- A storage tank with a pressure pump is placed on the pump skid for the first filling with deionised water and for compensation of evaporated water during operation.
- The make up water system works automatically and keep the expansion tank water level constant.
- The make up water flows from the storage tank through a 50 µm filter, then the make up water pass the ion exchanger and flows finally into the main water circuit.
Two ion exchanger chambers are installed on the pump skid.

The ion exchanger is hydraulically switched in bypass to the main water line.

A mixture of 50% anion and 50% cation (H+/OH-) is used for the resin.

Water flows from top to the bottom through the ion exchanger.

Valve cooling – ion exchangers
Six cooling towers are installed to cool down the fine hot water coming out from the valves.

One tower consists of two cooling coils with stainless steel tubes and seawater resistance aluminium fins.

Two axial type fans are mounted on the top flow. The fans work on the suction side in parallel to the cooling coil surface without baffle sheets.

Because there is no baffle sheet, the working fan will cover the whole cooling coil surface, therefore the lost cooling capacity will be less than 50% of the tower.
• Each fan is provided with Variable frequency Drive (VFD). This regulates the speed of the fan depending on the water temperature.
• If one fan fails, the speed of the remaining fans will be increased automatically.

• A spray water distribution pipe with nozzles locates on the top of each cooling coil.
• Water will be sprayed over the coil if the water inlet temperature exceeds specified limit.
To avoid scaling on the cooling coil fins, the spraying water will be treated by a reverse osmosis* unit.

The incoming water from the station supply will be filtered, softened by the reverse osmosis unit and stored in the spray water storage tank.

The same water is used to make up the loss in the main water circuit.

High pressure pumps each of 100% capacity are used for the spray water lines.

*slow change in concentration: the flow of a solvent by diffusion through a semi permeable membrane from a more concentrated solution to a less concentrated one, until the concentrations are equalized. It is a major factor in regulating the movement of water into and out of tissues in living organisms.
Valve cooling system-control

- Controlled by two redundant SIMATIC S95U programmable controller.
- The PLC working independent of each other.
- The PLC generates the necessary status, alarm and trip signals for the station control.
- The inlet water temperature to the Thyristor valve modules is maintained at constant value for every load and ambient conditions.
- A digital process controller SIPART DR22 is used for the temperature control.
- The controller output signal is used for the set point of the cooling fan speed.
- Start and stop signal for the fans is given by the PLC.
- 80 KVA UPS is provided as backup power supply. Since the outage of main pump generates immediate trip to the pole.
Expansion tank

- The expansion tank is placed on the highest point of the cooling system. The tank size is big enough to store the expanded fine water volume.
- The expansion tank is an open type expansion tank, the construction of the tank allows the air to come in contact with the water, but dust cannot enter the tank.
- Thyristor valve manufacturer requires oxygen-saturated water, therefore the need of an open system.
- The tank is connected to the suction side of the main water line, the connection to the discharge main water line will be used for circulation and for venting.