

Environmental challenges in Variable Speed Drive system applications

Design and Construction of a Water Cooling Unit facing
extreme temperatures and continuous critical duty

By: Adriana Batistoni Ferrara, Luca Bacchetti,
Gianbattista Ramundo

Date: June the 5th 2012

Venue: Kuala Lumpur, Malaysia



Patron



Host

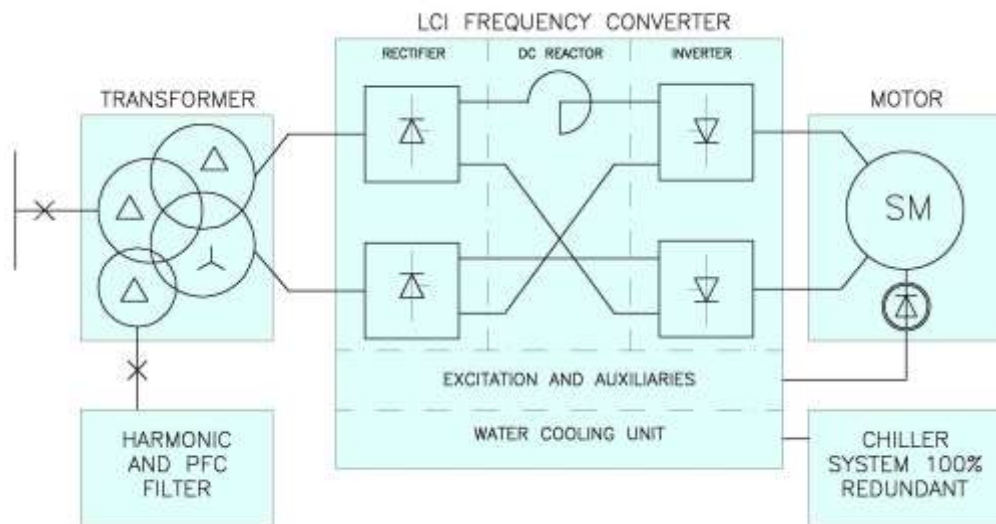


Host Sponsor



Variable Speed Drive system (VSDs)

- Main advantages of Electric Drives versus Gas Turbines in pumps and compressors applications
 - Higher flexibility (often pumps and compressors run at partial load)
 - Higher efficiency and energy savings
 - Lower maintenance costs
 - Lower environmental impacts



Typical configuration of a large VSD system for compressor applications

- 4-windings transformer
- Synchronous Motor
- Load Commutated Inverter (LCI), complete with cooling system
- Harmonic and Power Factor Compensation filter

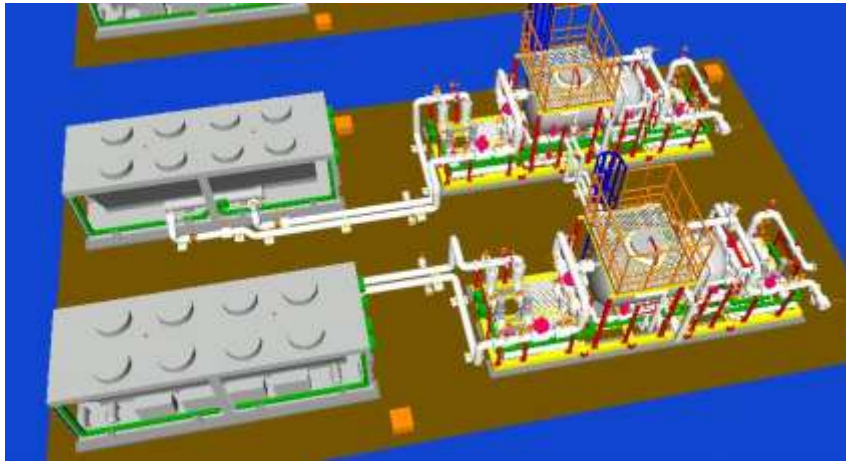
Cooling system configuration

- Thyristors and DC link reactor are cooled with de-ionized water in the LCI primary circuit to avoid corrosion due to electrical potential differences
- Redundant water to water Plate Heat Exchangers with raw water in the secondary circuit
- External cooling system 100% redundant, featured with:
 - 2 Refrigerant units
 - 2 Water tank and pump skids
 - Immediate change-over to ensure continuous cooling duty and high reliable operation



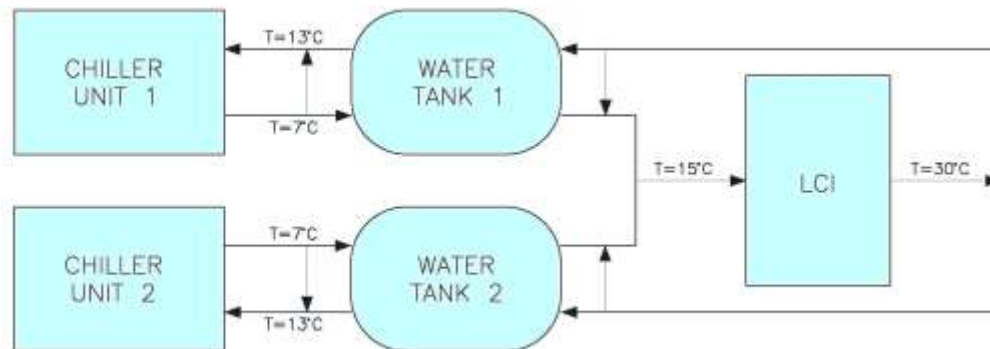
Critical design constraints

- Design parameters
 - Design temperature 55°C
 - Maximum temperature 60°C
 - Maximum cooling capacity of 272kW at 55°C
 - Desert environment



- Continuous critical duty
 - 100% redundancy
 - Cold stand-by configuration
- Chiller unit configuration
 - 4 reciprocating compressors
 - 1 shell and tube evaporator
 - 4 condensing coils with 2 air fans each
 - full-load test in thermostatic chamber (55°C)
- Water tank and pumps skid configuration
 - Piping and tank in stainless steel AISI 316L
 - Nitrogen blanketing of water tanks
 - Redundant inlet and outlet pumps

- Power and control system configuration
 - MCC with withdrawable drawers and intelligent relays to feed and protect compressors and fans motors
 - Redundant PLC to manage and control the process parameters
 - Digital direct control (DDC) to start/stop the compressors with reference to the outlet water temperature
- Process parameters to be controlled
 - Water temperature and flow rate to LCI
 - Buffer tank water level
 - Pumps discharge pressure
 - Working hours for compressors and pumps motors



Conclusion

