

Variable Speed Drives Give Cool Savings



The installation of variable speed drives for fan control in a cooling tower at the Teesside Power Station is reducing downtime as well as giving the potential for improving overall generating efficiency.

Yet one of the initial reasons for the selection of Control Techniques Unidrive SP AC drives for the task was a very down to earth and practical one – they were the only ones that would retrofit into the cubicles previously used for the direct-on-line motor (DOL) starters!

Jon Scott, Senior Electrical and Control Engineer, px limited, the power station's operating company, explains. "We were faced with the need to replace six two-speed motors for one quadrant of the Q501 cooling tower and took the opportunity to consider the options available in view of the maintenance problems we were experiencing due to shock loads on the blades, bearings and gearboxes. When we costed the alternative of variable-speed drives combined with conventional off-the-shelf AC induction motors (at 20% of the price), the bottom line was much the same – but the additional benefits offered by variable speed drives made that proposition much more attractive. The only problem was the narrow dimensions of the existing control cubicles which we wanted to re-use to make the project cost-effective. Only one drives company – Control Techniques - could give us the drives features we wanted in a compact package that would fit."

Depending on load and ambient conditions the water inlet temperature is on average at 30°C and, after cooling, the outlet water is approximately 16.5 °C. The water flow is 8,000 kg/second (12 Olympic sized swimming pools an hour), requiring a cooling capacity of about 460 MW provided by the 22 fans that supply an airflow of almost 10,500 kg/second (the equivalent of 20,400 domestic fans).

"It's a very aggressive environment and motors suffer from high corrosion" adds Jon Scott. As a result px limited was experiencing increasing downtime on one quadrant through excessive wear and tear on the fan blades, bearings and gearbox. "The DOL starters produce mechanical snatch on high-inertia components," explains Jon Scott, "whilst, with the variable-speed drives, the fans are started gently and ramped up to its two speed set-points. Equally, the stop sequence is a pre-determined ramp-down. We expect to see major benefits of reduced maintenance on this quadrant."

The company has retrofitted six 132 kW Unidrive SP AC drives into the DOL starter suite, each fitting comfortably into its narrow cubicle. The drives operate in open-loop control, with additional on-board I/O providing sequencing control, interfacing to the existing system and px plans to install Ethernet modules for data acquisition at a later date. "We were concerned about the possibility of excessive heat and noise from the drives," continues Jon Scott, "but in practice the drives run very quietly with very little heat output."

Since the drives were installed, it has become evident that variable speed drives in cooling towers have the potential to improve power station efficiency. PX is running the new variable speed controlled quadrant at a slightly higher speed than before, giving improved performance of that quadrant. "It's a very windy site," says Assistant Performance Engineer, Stefano Scazzola, "so that sometimes we have to reduce speed of a quadrant or the fans will trip out due to the vibrations. Using variable speed fans means that a complete quadrant can be ramped down to an intermediate point, keeping the quadrant in service. The performance of a cooling tower is crucial to the vacuum in the condenser on the steam turbines and the overall station efficiency."

KEY BENEFITS

- REDUCED MAINTENANCE
- POTENTIAL TO INCREASE EFFICIENCY
- SPEED RAMPED UP/DOWN
- RETROFIT INTO EXISTING CUBICLES



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