A.9: Upgradation in Indus-2 low conductivity water cooling system

Cooling water system in Indus complex provides cooling for Indus-2, transfer line-3 (TL-3), magnet coils, magnet power supply racks, RF cavities & their power supply racks, etc. It circulates the low conductivity water (LCW) at 29 ^{0}C in the closed primary loop. A plate type heat exchanger (PHE) transfers the heat to a secondary side cooling loop, which finally dissipates its heat into the atmosphere through cooling tower units. The achievable cold-water temperature and performance of this evaporative cooling system is highly dependent on relative humidity of the atmospheric air throughout the year.

To meet the supply water temperature of 26±0.5 ^{0}C in place of 29±1 ^{0}C as per the new requirement, it was decided to install and commission a refrigeration based new secondary cooling system in the upgraded chiller plant area as shown in Figure A.9.1.

Fig. A.9.1: Developed water cooled chiller plant area with automatic tube cleaning system.

Fig. A.9.2: Three numbers of 180 TR water cooled chillers with electrical panel, instrumentation & controls.

Hence, a new water-cooled, refrigeration based chiller plant was developed and commissioned along with three water-cooled chiller units having flooded type evaporator devices, pumping system, pipelines, heat exchangers, instrumentation & control system as shown in Figures A.9.1 and A.9.2. This provides very fast cooling response for required demand of accelerator machine components. The chiller has shown to achieve 0 to 100% RLA (rated load amps) within 12 minutes. Another aspect of the operational behaviour, achieving temperature control and stability within 26±0.5 ^{0}C is shown for one of these chillers in Figure A.9.3.

The chiller unit condenser tubes are made of Cu-Ni, which will provide long operational life. Moreover, for reliable performance, an automatic tube cleaning system (ATC) has also been installed, which caters the requirement of condenser cleaning for online removal of the scale deposits and maintains the heat transfer effects of the condenser tubes, internally.

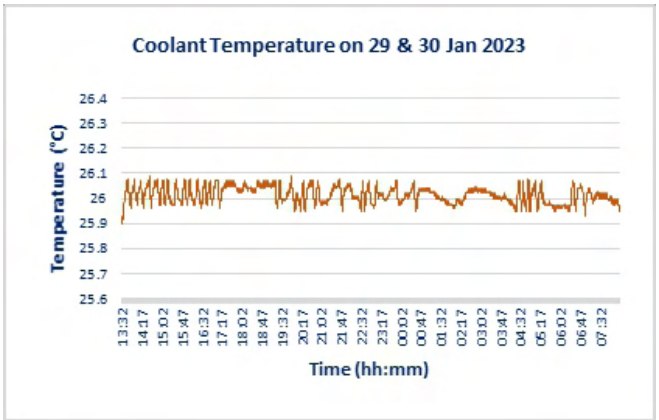

Fig. A.9.3: Operational performance of upgraded Indus-2 cooling water system providing temperature stability of 26±0.5 ^{0}C with integrated chiller system.

These chiller units were tested on site to ensure trouble free operation by operating continuously for 72 hours with available thermal load before putting into service.

Now, with the upgraded cooling system in place, the LCW water is being provided at 26±0.5 ^{0}C to TL-3 magnet coils, magnet power supply racks, RF cavities & their power supply racks in 24x7 mode, which will increase the operational life of the subsystem components. For more details, please refer to: *M. K. Singh, R. M. Pandey, Rakesh Kumar, Yogesh Kumar, Ravi Parkash, Jimmy James, T. A. Puntambekar, "Improvement in Indus-2 coolant temperature stability during beam energy ramp-up with Flooded Evaporator Type Chiller System", 11th DAE–BRNS Indian Particle Accelerator Conference, 13-16 March 2023, BARC, Mumbai.*

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