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Unit 1, 23 Richland Avenue Coopers Plains Q 4108



Corrosion Monitoring Using KPI3 system

KPI v3 is a unique system to monitor, control and Datalog the cooling water treatment parameters including Corrosion, pH, ORP, Conductivity, Temperature, Flow and Velocity. The online corrosion monitoring (using Linear Polarisation Resistance technique) on two selected metals provides a very accurate and precise tool for the users to have continuous monitoring and control on the system and prevent any damage to the heat exchangers and other in contact equipment.

The principals of online corrosion monitoring are shortly described as follows:

Linear Polarization Resistance (LPR) Monitoring

The Linear Polarisation Resistance technique is based on complex electro-chemical theory first established in about 1956 as the Stearn Geary equation. For purposes of industrial measurement applications, it is simplified by electronics to a very basic concept. In fundamental terms, a small voltage (or polarization potential) is applied to an electrode in solution. The current needed to maintain a specific voltage shift (typically 10 mV) is directly related to the corrosion on the surface of the electrode in the solution. By measuring this small current produced, a corrosion rate can be derived.

The advantage of the Linear Polarisation Resistance technique is that the measurement of corrosion rate is made instantaneously (almost every 10 minutes). This is a more powerful tool than coupons where the fundamental measurement is metal loss and where some period of exposure (typically weeks to months) is required to determine corrosion rate. The advantage to the Linear Polarisation Resistance technique is that it can be successfully performed in cooling water systems with reasonable conductivity and reasonably clean aqueous electrolytic environments. Linear Polarisation Resistance will not work in water with low conductivity (less than 250 μ S/cm) or in gases or water/oil emulsions where fouling of the electrodes will prevent measurements being made.

Parameters Affecting Corrosion and LPR

• Temperature

Increase in temperature increases the corrosion rate. This has been considered in KPI3 corrosion monitoring system by considering the fact that the Ionic Strength of the water is increased by any increase in temperature.

• Flow regime

According to the NACE standards the flow regime around the test coupons should be turbulence and uniform in the all directions, and representative of flow regimes in heat exchangers. The Aquarius ring probes ensure the totally uniform flow regime over the probes, while the turbulence flow is assured by the control of velocity across the specimens. The specimens are cut from condenser tube materials to ensure uniformity of metallurgy in testing.

• Velocity

Velocity is another parameter which directly affects the corrosion rates. The corrosion rate is normally increased by any increase in the water velocity. The stagnant water has



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the lowest general corrosion potential (but highest pitting potential). Too much increase in flow velocity will again increase the corrosion rates due to the accompanied erosion. At the normal operations the water velocity is set and maintained to be 1-3 m/s and this should be precisely simulated by the controller to be a real representative of the worst conditions of water velocity in the heat exchangers. A flow controller installed on the KPI3 manifold enables the users to set the velocity on the desirable amount and consequently measure the real corrosion rates of the heat exchangers tubes.

Aquarius Corrosion Probes

Rings of Mild Steel and Copper are machined from condenser tubing to manufacture the probes, and ensure the same metallurgy and thus a high accuracy of actual corrosion readings to system conditions - Large surface area of 10 cm^2 increase accuracy of results.



The Aquarius ring probe ensures the uniform flow regime for corrosion monitoring

Flow or velocity rate across the probe is set to simulate the velocity through the condenser and are automatically maintained in the manifold.

Other Advantages of Aquarius KPI v3 Controllers

- Improved accuracy from combination sensors
- Better accuracy from ring probe corrosion sensors
- Better corrosion accuracy from the controlled velocity
- Vastly improved dosage control via APL logic embedded in the firmware
- pH and ORP are truly dosed on demand from the system with a lock out feature setting for extra safety
- AquaReporter WEB based software allows for a five year data history on each unit
- Alarm relay is standard no volt for Direct Digital Control or Building Computer Management System
- BCMS outputs are available as an option for all relays, alarms and inputs
- SMS and e-mail alarm capability if required
- Automatic blow down of bleed off via conductivity control with 15mm bleed solenoid and 20mm manifold is a standard feature