STEAM TURBINE DEPOSITS

By Sydney Gross

Steam turbine deposits are a direct result of boiler water impurity from all sources of water that enter the system such as feed water, make up water and attemperation. Impurities may also originate internally from paints, sealants, gaskets, blasting media, corrosion products, etc. Often, impurities will settle in the drum only to be stirred up and carried over in high concentration during boiler upsets. Although these impurities may be in low concentration in the steam, a few parts per billion (ppb), their concentrations can become much higher as they deposit in the turbine. The most common impurities found in steam are sodium chloride, silica and iron oxide.

Turbine deposits may start out as solid particles in the steam but more commonly exist in solution. As the steam looses pressure and temperature in the turbine, impurities come out of solution much like dissolved salt will come out of a water solution as it cools. The impurities will then attach to the turbine components through different mechanisms such as impact or evaporation.

Steam impurities deposit in various locations in the turbine wherever expansion of the steam occurs. Deposits form on valve parts causing sticking and in seal areas between the rotor and stationary seal causing wear damage to the rotor, seal or both. Deposits form on the rotor discs, blades and shrouds resulting in pitting corrosion, stress corrosion cracking and corrosion fatigue. In more severe instances, rotor to stator clearances may be closed and rubbing can occur. Deposits also adhere to the flow path components, diaphragm and nozzle vanes and rotor blade surfaces, thus reducing flow area and increasing surface roughness resulting in reduced capacity, reduced efficiency and higher thrust loading. Uneven deposits on the rotor can result in elevated vibration levels.

Turbine performance should be monitored regularly for signs of deposits. These signs include first stage pressure and active thrust temperature trending upward and radial vibration levels trending upward or jumping upward. Visual signs of deposits can be detected where steam escapes the turbine at locations such as seals, valves or casing joints of dubious integrity. Deposits are typically white and crystalline. Samples of deposits should be collected and analyzed to determine their origin.

The most obvious preventative measure but hardest to implement is improving the purity of the water. Tighter boiler controls, which limit upsets, and regular boiler blow down will help prevent deposits resulting from upsets. Other methods for preventing turbine buildups include improved flow path surface finishes and anti-fouling coatings. Both will extend the period before fouling becomes an issue. Once adhered, some deposits can be removed through on-line or off-line water washing. However, silica deposits tend to be more tenacious and often require blast cleaning of the rotor.

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