TURBINE STEAM PURITY

By Scott MacFarlane

When it comes to steam turbines, the steam purity is a prevailing concern to the turbine's functionality and life expectancy. Steam purity is defined as the amount of solid, liquid or vaporous contaminates found in the steam.

Basically, any particles besides the pure steam are considered contaminates and these particles can have a severely detrimental effect on the overall operation of the turbine. These contaminates can originate from many different sources throughout the process of converting the feed water to steam. Boiler carryover, feed water impurities and vaporization of silica and other compounds are just a few examples. There are industrial steam contaminate limits set by manufacturers that should be followed to determine if the steam is acceptable. The chart below is an average turbine manufacturers recommended limit for some commonly found contaminates.

Manufacturers Recommended Steam Purity Limits	
Sodium	5 - 20 ppb
Silica	10 - 20 ppb
Chlorides	3 - 15 ppb
Sulfates	3 - 15 ppb

Reduced steam purity can cause internal components of the turbine to accumulate deposits and cause severe corrosion. The more serious types of corrosion are stress corrosion cracking and corrosion fatigue. Stress corrosion cracking is the collaboration of corrosion and mechanical stresses to cause a failure by cracking the surface. Corrosion fatigue is the collaboration of corrosion and alternating or cycling stresses that causes a rupture of the surface, which in turn accelerates the corrosion. These specific cases of failure are particularly detrimental during cold startups due to large condensation of steam. When the turbine reaches its operating temperature, the condensate evaporates leaving concentrated contaminates on the surface. Unfortunately these concentrations of contaminates mainly form on hard to reach surfaces where the steam's flow cannot provide a washing effect. These surfaces also happen to be heavily stressed areas which will increase the chances for stress corrosion failures. Rotor blades and vanes manufactured from an AISI 403 12%Cr stainless steel is the most commonly used material to prevent these failures. Other potential hazards that are associated with the steam's purity come in the form of erosion, particle accumulation, flow obstruction, high thrust loading and sticking of valve stems. An example of flow path deposits from steam impurities can be seen in the photograph.

For more information:
Email: rms@rotatingmachinery.com
Tel: 484-821-0702

Headquarters
2760 Baglyos Cir.
Bethlehem, PA 18020

Houston Office
16676 Northchase Dr., Ste 400
Houston, TX 77060

rotatingmachinery.com
Tel: 484-821-0702
Parts: rms@rotatingmachinery.com