UV Detection of Trace Sugar Contamination

in Boiler Water

Key Benefits

- **Real-time, in-line measurement**
- **Exceptional sensitivity for trace (ppb-level) detection**
- **High-performance UV LED light source**
- **Drift and noise-free measurement**
- **Zero maintenance measurement cells & fiber optics**
- **Suitable for high-temperature process lines**
- **No sampling system or sample conditioning required**
- **Analog output (0/4–20 mA) & Modbus over TCP/IP**
- **Remote web-based configuration and data trending**

In sugar refineries, high-purity boiler water is essential to prevent foaming, corrosion, and deposits on heat transfer surfaces. Trace amounts of sugar introduced through leaks in evaporators or heat exchangers can significantly reduce boiler efficiency, driving up operating costs and causing unplanned shutdowns. Early detection of sugar ingress is therefore an important operational priority.

Limitations of Conventional Leak Detection Methods

Most instruments used to monitor sugar contamination in boiler and condensate systems rely on refractive index (RI) or conductivity measurements, and both respond only to large contamination events. RI detectors typically require sugar concentrations of 2–5 wt% or higher before a meaningful signal appears, while conductivity instruments respond to ionic species and are largely insensitive to non-ionic contaminants such as sucrose.

As a result, small leaks, such as pinhole failures in evaporator tubes, go entirely undetected. A pinhole leak may introduce sugar at the parts per billion (ppb) level, well below the threshold of these instruments. Over time, even trace concentrations promote fouling, accelerate corrosion, degrade heat transfer, and ultimately cause boiler damage that earlier intervention could have avoided.

The Case for UV Absorbance Monitoring

UV absorbance monitoring addresses this gap directly. Sugars absorb UV only weakly, but their degradation products, formed under the high temperatures and alkaline conditions typical of boiler systems, absorb strongly in the 200–300 nm region. Compounds such as furfural, hydroxymethylfurfural (HMF), and caramelization byproducts form reliably from trace sugar and act as UV-active markers of sugar intrusion.

UV monitoring therefore does not measure intact sucrose or glucose directly; it detects these decomposition products, which serve as a consistent, predictable proxy for sugar ingress. Because UV detectors respond at ppb levels, orders of magnitude below RI-based instruments, they are well suited to catching the slow ingress of sugar through pinhole leaks that would otherwise go unnoticed until the damage is done.