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User Groups Gas Turbines HRSGs Controls

HRSG coverage increases at WTUI as LM cogen, combined-cycle facilities multiply

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Over the last three Western Turbine meetings, HRST Inc's Ned Congdon, PE, has built an enviable following among aero owner/operators with heat-recovery steam generators. At the 25th anniversary conference in Long Beach, Mar 15-18, 2015, he and colleague Jack Odlum presented on HRSG economizers at one of the Tuesday afternoon special technical sessions.

Congdon, a dyed-in-the-wool boiler guy with decades of experience, never repeats subject matter from meeting to meeting. That's probably why his session is always full. Attend for five or six consecutive years and you might qualify for a degree. In case you missed his presentation in 2014, the focus was on reducing the startup time of aero combined cycles; in 2013, he provided solutions to HRSG inlet-duct challenges.

Congdon and Odlum began this year's presentation with a review of the two principal economizer designs for HRSGs: panel type and return bend. Flow patterns characteristic of each design, and the importance of vents and drains, were included in the subject matter. To access the basics, read *In the boiler business this is front-page news.*

Thermal shock. This CCJ article also describes how thermal shock occurs in panel-type economizers and how HRST's ShockMaster® avoids it. Simply put, ShockMaster is a special type of economizer where water flows up in all panels, enabling it to resist tube cracking and other issues caused by the thermal gradients experienced in some conventional economizers where water flows both up and down in each panel.

Buoyancy instability was the next topic addressed by the speakers. Like thermal shock, it is a cycling issue—one that causes flow stagnation (sometimes even reverse flow) in down-flow tubes in panel-type economizers. When stagnant (and reverse flow) tubes become hotter than neighboring tubes because heat transfer is compromised, tubes are severely stressed and fatigue failures can result because it's possible to have hundreds of thermal cycles daily. The risk of buoyancy instability is greatest at low loads.

Congdon suggested users have three solutions at their disposal to mitigate buoyancy instability in panel-type economizers. They are:

- Recognize that certain operating loads are damaging and avoid them.
- Increase water velocity in economizer tubes with a recirculation circuit.
- Modify the flow circuitry of pressure parts.

In return-bend economizers with low design velocities, buoyancy causes water in some circuits to flow very slowly (almost stagnant), and others to flow quickly. If the gas temperature is above the saturation temperature, stagnant tubes will vapor lock—that is a steam bubble is trapped in the return bend. The bubble will remain there until the load increases enough to clear it. However, the speakers said this might never happen. Operations personnel know when a vapor lock clears; the banging and clanging of water hammer is distinctive. An interesting point made was that different tubes may become stagnant from one startup to the next. Also, it is difficult to modify existing systems to correct the problem. If a return bend fails in service, consider replacing it with one having a thicker wall.

Congdon and Odlum closed out their presentation with highlights of their thinking on drain cracking, corrosion under insulation, freeze damage, and performance thieves.