

Vogt's effort to develop a new product in the Once-Through Steam Generator (OTSG) grew from a large capital project we chased back in 2009. The project was for twelve units behind aero-derivative LM6000 gas turbines. Our typical drum-type HRSG was a superior design and was offered at a lower installed cost, yet the customer chose our competitor's higher cost OTSG because of its unique operating characteristics. Although the OTSG market had been small, and remains so today, it was nearly monopolized by Innovative Steam Technologies (<http://otsg.com/>). With our design expertise and world-wide sourcing capabilities, we knew we could take a good share of their business. Therefore, an effort was launched to develop the analysis tools necessary to develop our own OTSG design. We even had a long-term customer, Anchorage Municipal Light and Power, planning an OTSG plant who we targeted for our first design.

In our R&D effort, we interviewed several operating OTSG plants. Common problems were identified with the typical OTSG design offering. Most simply, the OTSG is nothing more than a long bundle of fintubes: cold water enters one end and superheated steam exits the other end as the tubes snake through the gas turbine exhaust duct. The fleet of competitor's OTSGs were designed to start and stop while the GT remains in part load operation. The problems observed in these units were not surprising given the on/off nature of introducing feedwater to the boiler. Extreme thermal-mechanical stresses were occurring in the cold end of the unit, obviously caused by startup, resulting in a tangled mess of fintubes. Tube damage was also observed in the hot end where, during shutdown. Tubes which used to contain superheated steam now had a slug of hot water passing through when the water supply ceased.

To develop a more robust OTSG, our patented design focuses on dramatically reducing the thermal stresses typical of an OTSG startup. To accomplish this, we developed a steam/water separating Loop Seal Separator. This separator is simply a small vessel located between the evaporator and superheater sections of the OTSG. In normal gas turbine operation, it has superheated steam entering and exiting. However, during startup and shutdown, it can allow water to circulate through the OTSG, by use of a small pump, in order to reduce the thermal stresses. With its use, the Loop Seal Separator can provide a controlled cooldown of OTSG tubes where previously cold water entering tubes resulted in immediate quenching.

This invention was also approved in Canada under patent 2,822,847. Further work with Canadian authorities resulted in Canadian patent 2,890,601 which provides additional equipment for protecting OTSG components during startup. Unfortunately, this device was rejected for United States patent protection.

Fast forward to today, and we still haven't sold an OTSG. Our target customer in Anchorage had too much concern over buying "serial number 1" from Vogt, in spite the fact they have a Vogt HRSG vintage 1975 which is still running strong. As we understand, the mayor of the city-owned utility had final say, and the fact it would have been our first OTSG installation was too much risk. Some good news is that this effort was not in vein. We have regularly received OTSG proposals over the years and are fully capable of supporting those efforts. And we are incorporating some of the design features into development of vertical HRSG technology in preparation of supercritical HRSG designs.