Case Study

Steam Turbine Crossover Expansion Joint for a New GTCC Power Plant

In Gas Turbine Combined Cycle (GTCC) power generation, gas and steam turbines are used in combination to generate electricity in two stages. In the first stage, a gas turbine generates electricity; in the second stage, steam produced in an HRSG generated by high-temperature exhausts from the gas turbine drives the steam turbine, again producing electricity. This dual configuration enables GTCC plants to achieve higher thermal efficiency than conventional coal fired power plants.

The steam turbine uses crossover ducting/piping to transport steam from the intermediate-pressure turbine exhaust to the low-pressure turbine inlets. The crossover allows differential thermal expansion between the crossover and the connecting stationary equipment without imposing large axial forces due to steam pressure. The crossover piping system typically requires a pressure balanced expansion joint to accommodate the movements and high pressure.

This expansion joint was recently manufactured for a new 400 MW (megawatt) GTCC power plant in Ireland. The PED expansion joint assembly included two-ply testable bellows constructed of 316L stainless steel for a Mitsubishi 701F 401 MW power module. The bellows were designed with root rings, that are installed around the outside of the bellows. They provide structural support to accommodate the pressure.

Root rings add structural support to the bellows, under internal pressure.

Pressure balanced expansion joints are installed in steam turbine crossover ducting to accommodate movements and high pressure.

Project description:

- 1200 mm Inside Diameter Pressure Balanced Expansion Joint
- Pressure: 5 bar
- Temperature: 325°C
- Bellows Mat'l: EN 1.4404-AISI 316L
- Media/Application: Steam
- Approval(s): PED Certified