



Fig. 1 – Power Plant Feedwater Heater Process diagram

**Application: Boiler Feedwater Heaters via Direct Steam Injection**

Power generating plants utilize steam boilers to produce electricity energy for their operation. These boilers often have feedwater heaters which are an integral part of the plant's thermodynamic cycle. The presence of the heaters in the cycle improves the thermal efficiency of the power plant by lowering the amount of thermal energy required to generate a given amount of electrical by re-using produced steam in a heat exchanger to heat feedwater prior to the Deaerator (Fig. 1).

**Issues Associated with Boiler Feedwater Heating**

- Heat exchangers are prone to mineral and scale build-up on the internal components. This scale build-up reduces their thermal efficiency and requires costly cleaning and replacement of damaged components.
- Mineral & scale build-up can lead to a plugging/fouling issue which increases energy consumption from the condensate pumps.
- Replacement of the heat exchangers requires considerable floor space and foundation improvement because of their size, weight, and cleaning access requirements.

**ProSonix Direct Steam Injection Heater Solution**

The PSX heater can be installed to heat up the returned condensate with low pressure steam from the turbine. Often times steam temperatures of 600 °F and feedwater temps of 400 °F are not uncommon. The key to efficient, safe, and predictable steam injection is the use of Internally Modulated steam control and to inject steam at sonic velocity to achieve choked flow. By achieving choked flow, sonic velocity conditions can be achieved for steam injection. The use of an integral pneumatic actuator allows for sonic velocity steam injection for the PSX Heater to operate in a choked flow manner for good, non-violent mixing. The PSX heater is an internally modulated heater, with a variable position stem plug, that varies the mass flow rate of steam by changing the area in which the steam may pass. This type of modulation allows the full steam pressure to always be present at the point of injection regardless of plug position.

**Key PSX Heater Direct Steam Injection Benefits ...**

- **Stable Operation** - The Internally Modulated steam control design of the PSX heater controls the steam mass flow and not the steam pressure thus eliminating steam hammer and vibration issues.
- **Lower Maintenance** due to the PSX heater's self cleaning design (no scaling or plugging/fouling)
- **Low Pressure Drop** across the PSX Heater (typically 1-2 psig) reduce pump integration issues and flow disruptions
- **Economical Installation** as the PSX heater can be installed in the piping with no floor space requirements.
- **Precise Temperature Control** (typically +/- 1 °F ) allows for a more reliable heating process
- **High Turndown** on both steam and liquid allow for process flexibility and process condition variations.

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