

PSX Technical Bulletin

Internally vs. Externally Modulated Steam Control

Externally Modulated Steam Control - Externally modulated steam control has been a common approach for Direct Steam Injection heating. This approach uses a remote steam control valve (PRV) to throttle (reduce) the steam pressure prior to a fixed opening steam injection point. Typically the steam pressure needs to be reduced at least 50% to control the amount of steam for temperature control. As the steam injection point has a fixed opening area, the reduced steam pressure also reduces the velocity (sub-sonic flow) of the injected steam.

Issues: Effective steam condensation rates are dramatically reduced as steam velocity is goes down. When low velocity steam injection occurs, sub sonic steam conditions exist. This results in:

- Low velocity steam leads to uncondensed steam bubbles, which tend to collapse against the pipe walls (Fig. 1). This is what leads to the vibration & steam hammer.
- Uncondensed steam can also travel past the temperature sensor which results in temperature control issues such as over heating.
- Process upsets are common and damage to equipment can occur from the steam hammer.
- Steam collapsing on the surface or in the steam Steam injector, leads to excessive wear which increases maintenance costs and reduces the Heaters reliability.

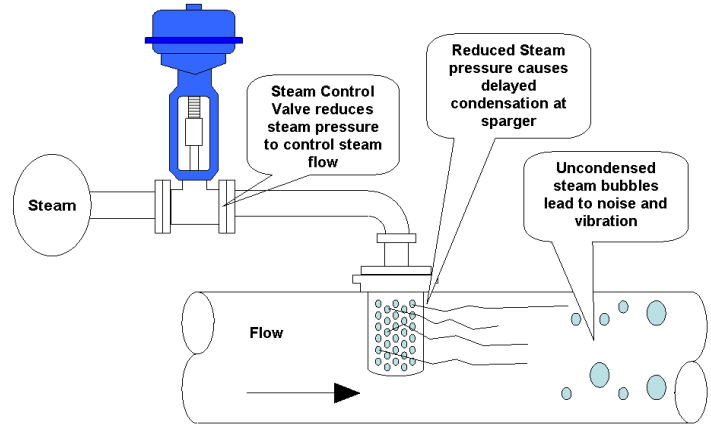
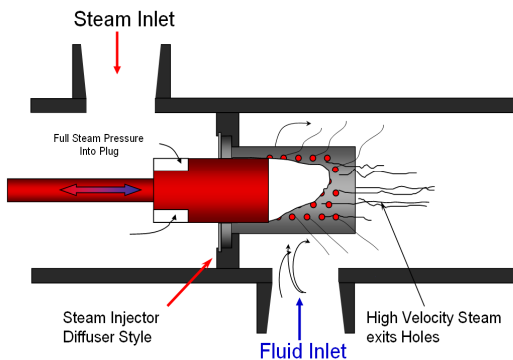


Fig 1 – Externally Controlled Steam Sparger

Internally Modulated Steam Control – ProSonix’ unique method of steam injection utilizes an internal steam control to precisely deliver the appropriate mass flow of steam for the required heating. This is achieved via an integral Pneumatic Actuator, and a variable position stem plug in the steam jet diffuser. We do not throttle or regulate steam pressure. This design offers a precise method of steam control through a choked flow control delivery of the steam. Choked flow is the phenomenon of accelerating a vapor to maximum velocity by creating a pressure differential through an engineered nozzle. By establishing choked flow, the steam mass flow can be metered to precisely control the heating of the liquid. This produces predictable results based on position of the stem plug. Through a variable-area steam diffuser, steam flow is metered at the point where steam and liquid first contact and mix. Internally Modulated DSI heating controls the mass flow of the steam and not the pressure.

PSX – Jet Diffuser



Advantages to Internally Modulated Steam Heating ...

- **No Process Upsets** - High velocity steam flow optimizes the steam mixing and condensation with the liquid and eliminates problems with vibration/steam hammer.
- **No Steam Control Valve (PRV) Required** - This method eliminates the need for an external steam control valve or downstream mechanical mixing devices.
- **Reliable Temperature Control** – Rapid and complete condensation of the steam allows for temperature reliable control of +/- 1 °F.
- **Self Cleaning Design** – High velocity steam also is self cleaning and eliminates debris along scale & mineral build-up on the steam diffuser.
- **Lower Maintenance Costs** – Proper condensation of the steam eliminates excessive wear on the surface of the PSX Heater’s mechanical surfaces.

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