

Once Through Steam Generators (OTSGs) in Fast Start and Cycling Applications

Innovative Steam Technologies

Overview

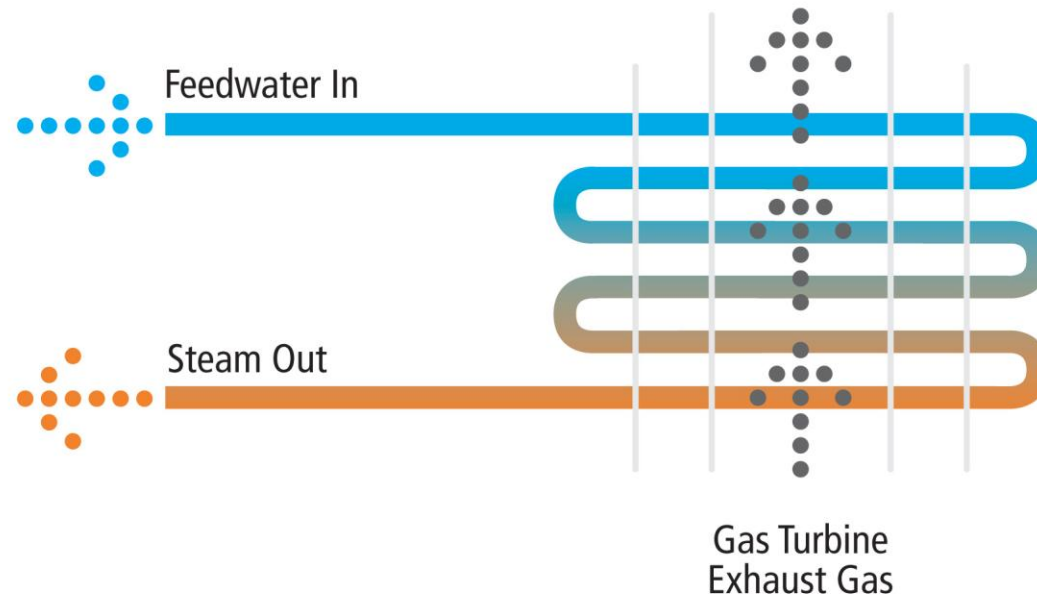
- Who is IST?
- OTSG – Drum-free HRSG technology
- Advanced Metallurgy
- Simplified Control System ⇨ Operational Flexibility
- Start-Up Curve

IST Company Profile



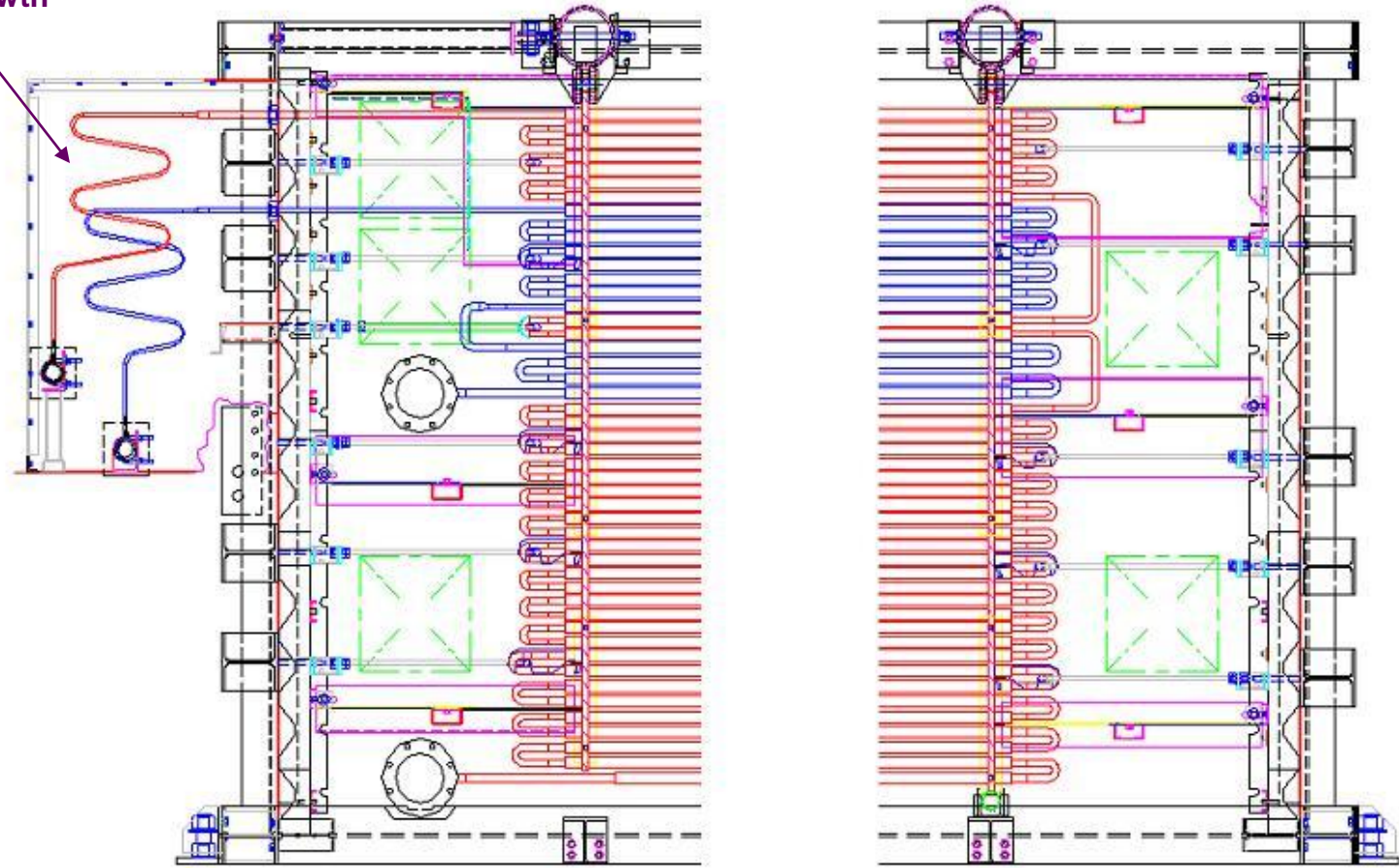
- Founded - 1985
- Sales to date – 140+ OTSGs
- +55 staff Design, Engineering, Service and Shop
- Sales Offices – North America, Europe

1. Drum-free Design



- All tubes thin-walled - low thermal mass - fast cycling
- Compact lightweight pressure bundle
- No fixed Economizer, Evaporator or Superheater sections

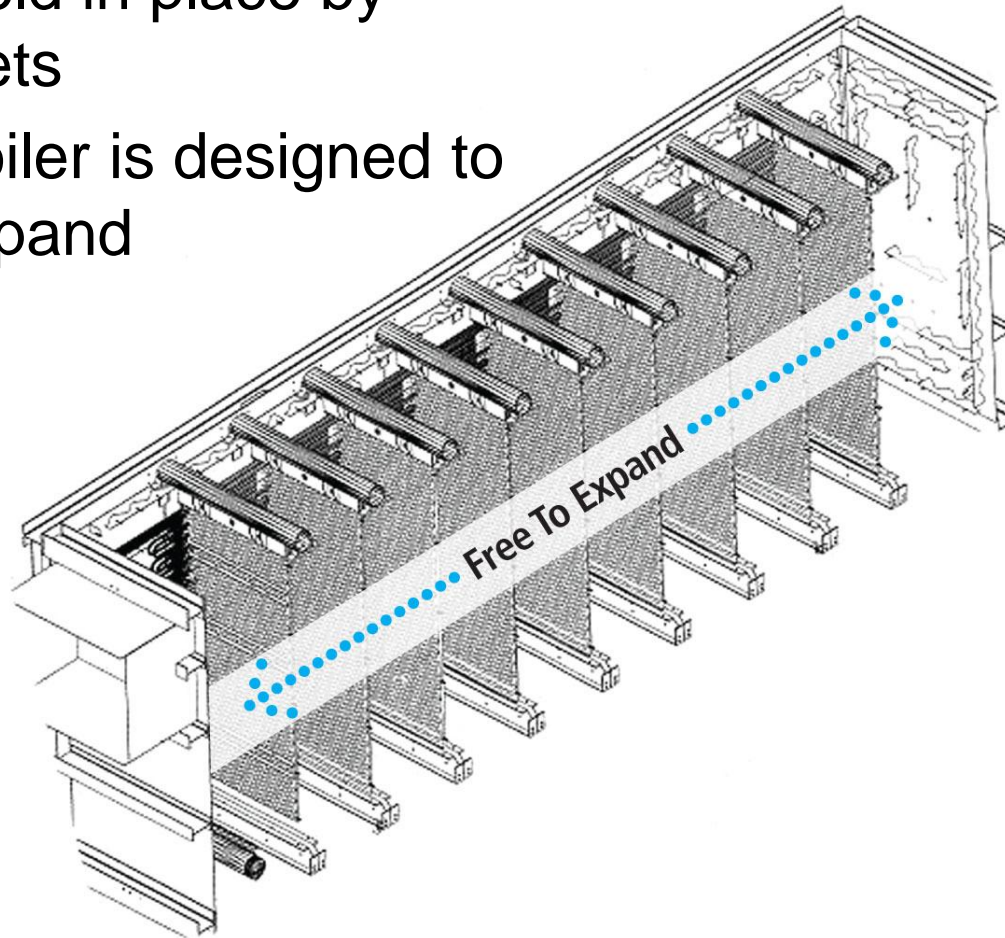
“Flex” tubes allow for thermal growth



- Typical dual pressure unit
- Note the feedwater flex tube and steam header locations
- *No thick walled drum to heat up*

Pressure Module Layout

- Tubes held in place by tubesheets
- Entire boiler is designed to freely expand



2. Advanced Metallurgy

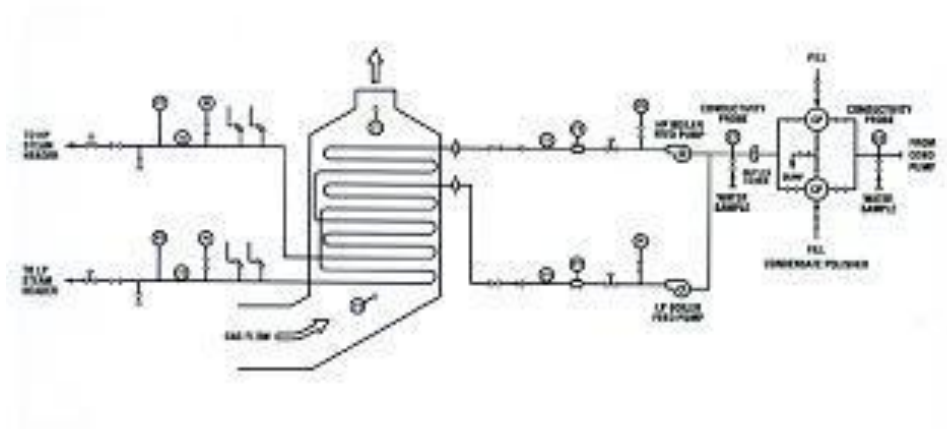
- Tube materials:
 - Incoloy Alloy 800 & 825
 - SB407 NO8800 & SB423 NO8825
 - High nickel content (+35%)
- High material strength allows for thin tube walls
 - *Less metal, quicker to heat*
- Smaller diameter tubes
 - *Lower inventory of water to heat*
- Dry-running up to 1000°F (538°C)
- Many plants operate in daily cycle start/ stop

Advanced Metallurgy

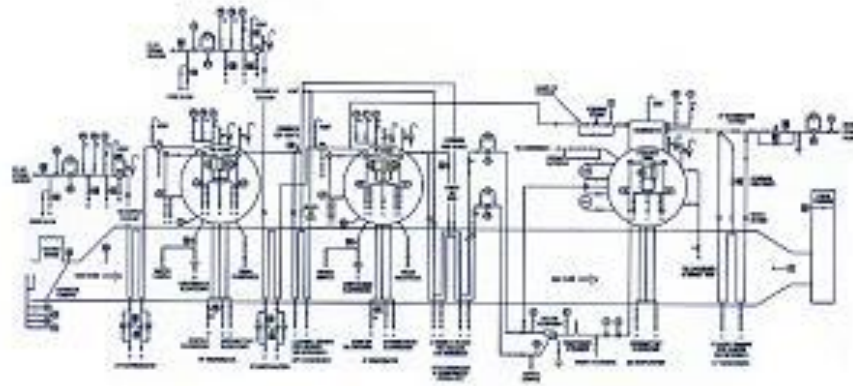
- Common HRSG Problems Solved by Using Alloy 800/825
 - Stress corrosion cracking
 - Dew point corrosion
 - Flow assisted corrosion
 - Thermal shock
 - Creep/ fatigue failures of superheater
 - Cycling/ daily start – stop
 - Starts and stops DRY

3. Simplified Control System

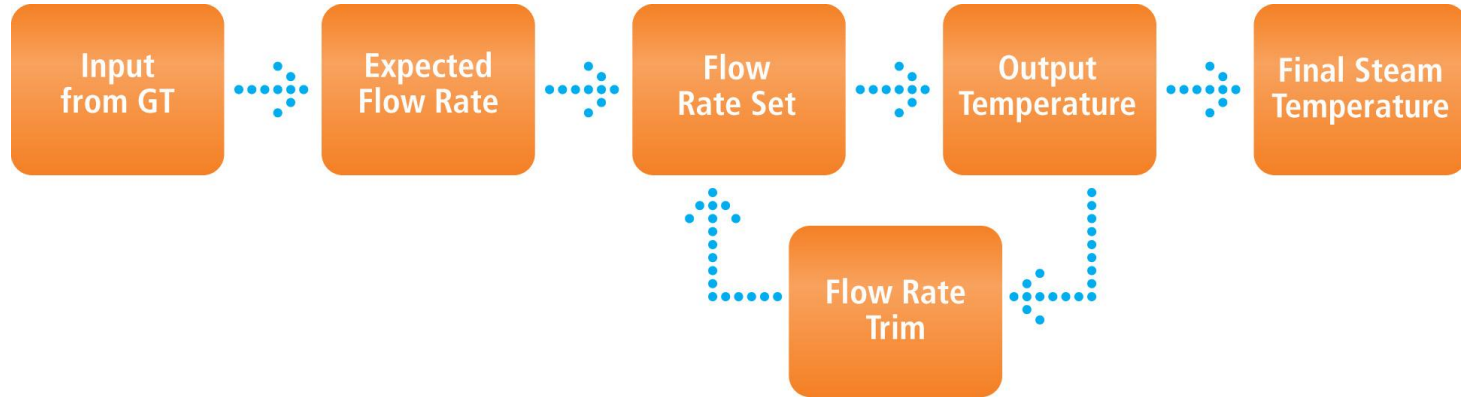
IST's
OTSG
P&ID



Typical
Drum
HRSG
P&ID



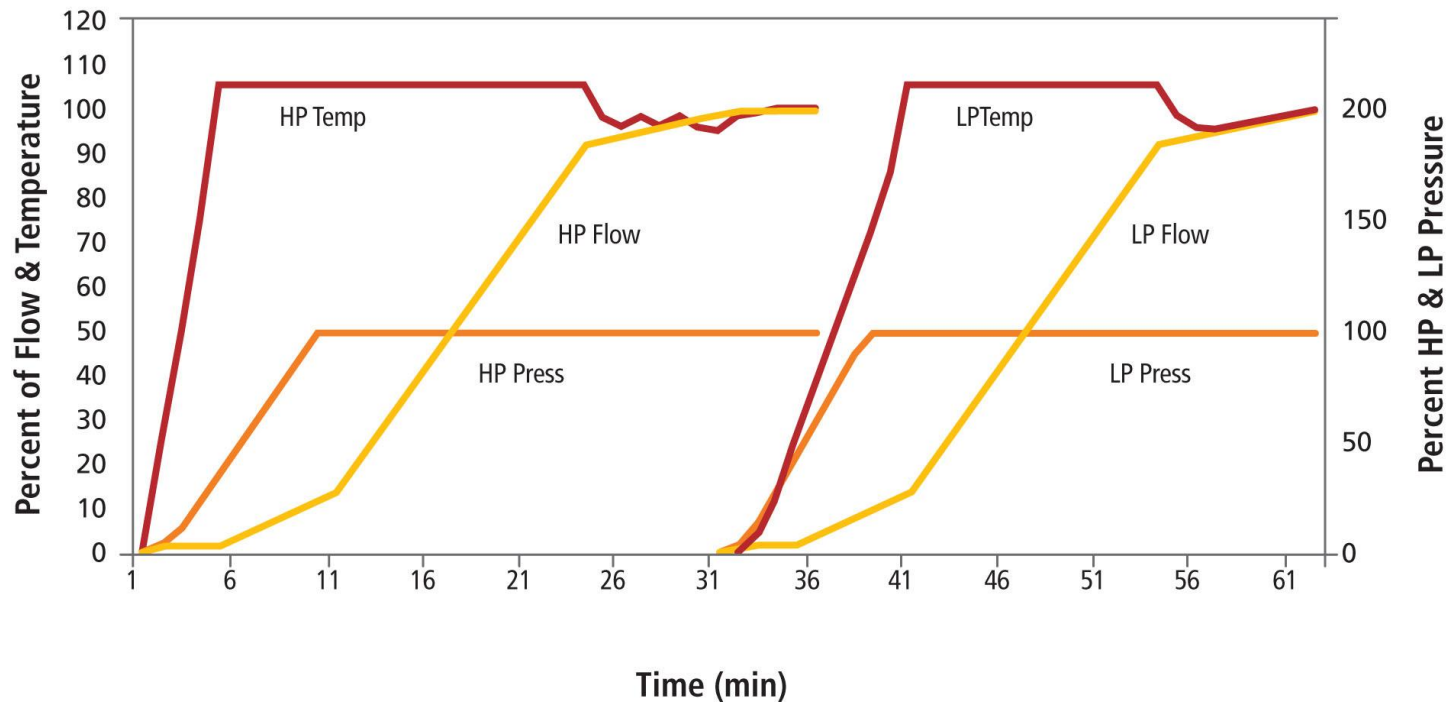
Simplified Control System



- Patented control system maintains constant temperature by regulating feedwater flow
- Feedforward control loop detects changes in gas turbine output
- Feedback control loop adjusts final trim of feedwater valve

Start-Up Curve

Typical Cold Start - Dual Pressure OTSG



- HP Steam under temperature control in ~30 Minutes
- LP Steam (if required) in control after ~60 Minutes
- *Usable steam after 15 minutes*

Key Takeaways

- Drumless design
- Advanced metallurgy
⇒ small diameter & thin walled tubes
- Low inventory of water and less metal
⇒ quicker response time
- No fixed economizer, evaporator & superheater sections - allows flexibility during start-up
- OTSG starts and stops dry

