How Dr. Heater© Reveals Design Flaw

Case #1- Serious Erosion in VDU Heater

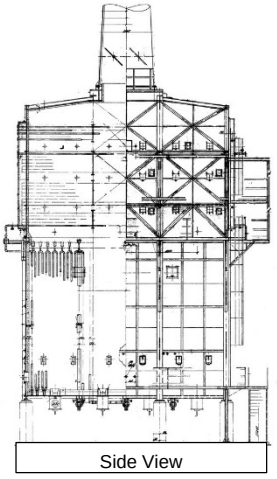
FHinfinity
Showcase Material

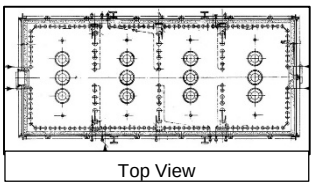
Introduction

A VDU heater experienced repeated tube failures due to severe erosion near the outlet, despite normal tube wall temperatures and no operational alarms. Traditional analysis couldn't explain the root cause until we applied **Dr. Heater©**, the FHinfinity's built-in diagnostic tool.

Heater Specifications

- **Firebox Type**: Box-shaped, Up-fired, Natural Draft
- **Number of Cell / Pass**: Four / Six
- **Number of Services**: Three (LPS, MPS, VDU Feed)
- **Tube Location**: Refractory-Backed / Central
- **Tube Diameter:** Varies across radiant section (4 different sizes)


Side View


Top View

Simulation Validation by FHinfinity©

Parameter	Design Value	FHinfinity Result
Total Heat Absorption [kW]	25222	25420
Avg. Rad. Sec. Heat Flux Density [W/m2]	29224	29444
Process Outlet Temperature [C]	412	411
Process Side Pressure Drop [bar]	0.5	0.7

High agreement confirms model accuracy

NEW

No Manual Cross-Checks. No Missed Warnings!

Introducing Dr. Heater©

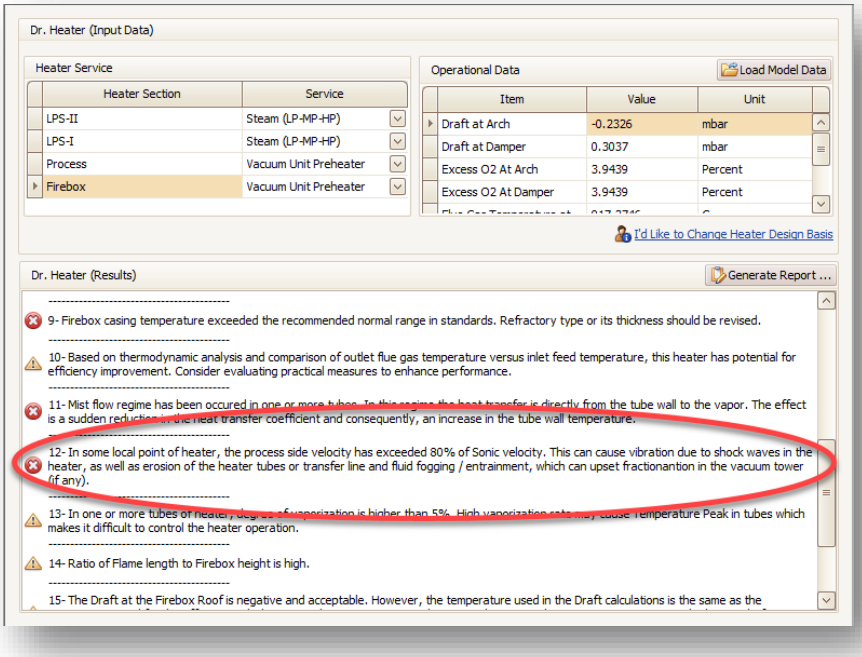
Dr. Heater© is an automated design validation module that checks your heater against industry standards (API, ASME, OEM guidelines) and best practices.

It flags potential flaws at 3 levels:

- ***Alarm**: Critical issue*
- ***Caution**: Risk under certain conditions*
- ***Note**: Design deviation worth reviewing*

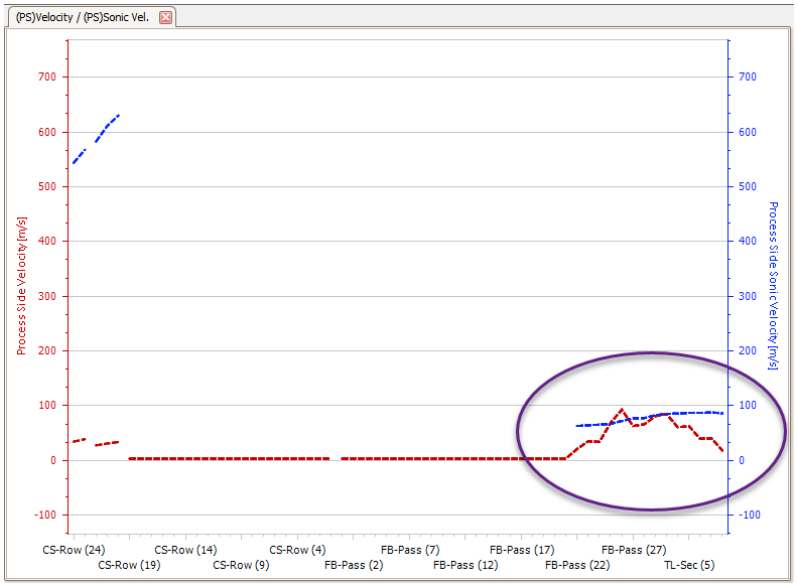
Diagnosis: Sonic Velocity → Erosion

Dr. Heater© identified a critical flow anomaly:



● "***In some local point of heater, the process side velocity has exceeded 80% of Sonic velocity***. *This can cause vibration due to shock waves in the heater, as well as erosion of the heater tubes or transfer line and fluid fogging / entrainment, which can upset fractionantion in the vacuum tower (if any)*"

This explains the repeated erosion at the outlet header, a flaw hidden in conventional thermal analysis.



Velocity / Sonic Velocity Curve:

- X-axis: Tube length
- Y1-axis: Linear Velocity [m/s] (red curve)
- Y2-axis: Sonic Velocity [m/s] (blue curve)

Engineering Insight

Erosion wasn't due to poor operation, it was a design-level flaw:

Dr. Heater© caught what others missed.