Endothermic Gas Generator Advanced Diagnostics

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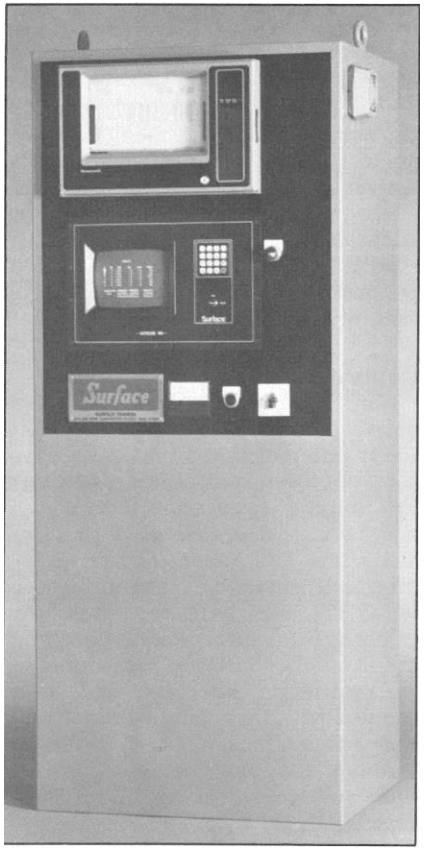
Surface Combustion

Generators Then and Now

Controls Then and Now



Preventative Maintenance

- Scheduled and performed to lessen the likelihood of a failing piece of equipment
  - Scheduled catalyst burn-out
  - Changing the catalyst in a retort
  - Changing or cleaning air cooler filters

Predictive Maintenance

- Techniques designed to help determine conditions of in-service equipment in order to predict when maintenance should be performed.

  This approach provides both cost and manpower savings because tasks are only performed when warranted.
  - Monitoring flow rates
  - Monitoring atmosphere quality
  - Monitoring temperatures

Advanced Diagnostics Tools

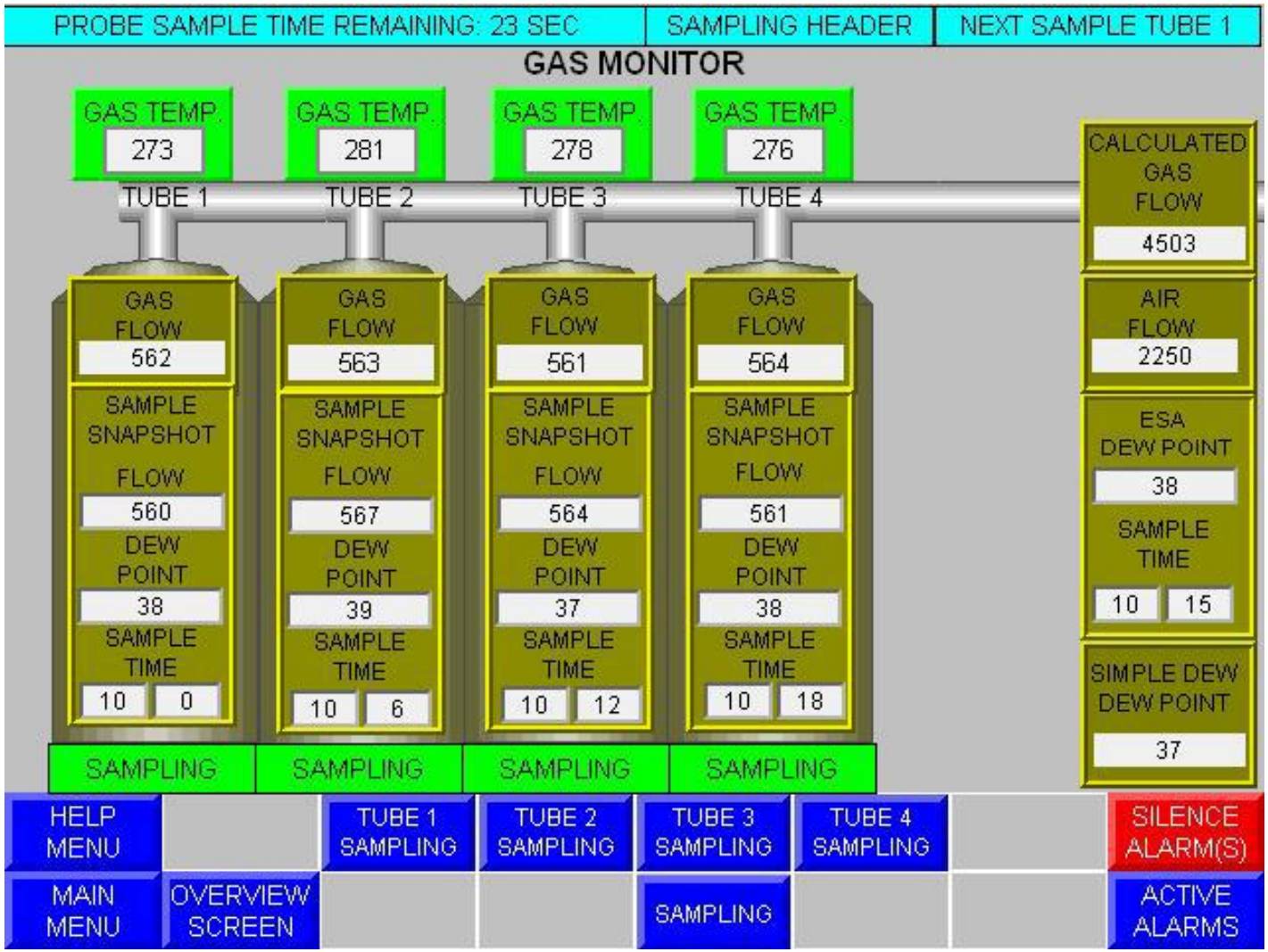
- Individual Retort Tube Dew Point Monitoring
- Individual Retort Flow Monitoring
- On-line Retort Comparison
- Exit Gas Temperature Monitoring

Individual Retort Dew Point Monitoring

- **Benefits:**
  - Deviation between two (2) retort dew points indicate catalyst may need to be burned-out or changed.
  - Deviation between main header dew point measurements can indicate one of the measurement devices is failing.
  - Could eliminate scheduled burn-outs in favor of burn-outs when required.

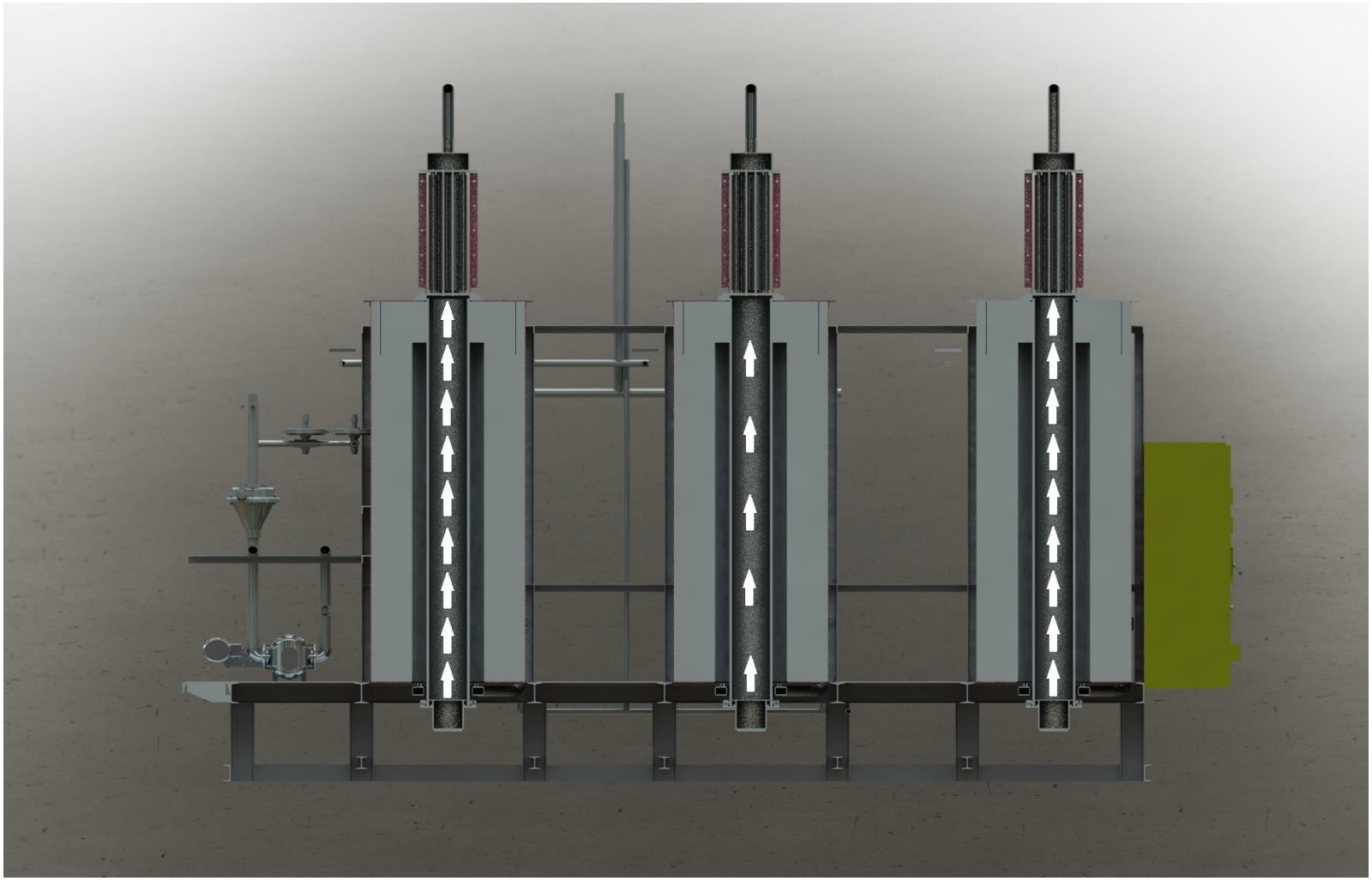
Individual Retort Dew Point Monitoring

- **Implementation:**
  - A time share sampling box allows each retort to be sampled for a given amount of time.
  - The main header is also sampled to measure the blended dew point.
  - Values are compared and alarmed.
  - A separate dew point measurement device is utilized to sample the header and control the dew point for the entire generator.


PROBE SAMPLE TIME REMAINING: 23 SEC
SAMPLING HEADER
NEXT SAMPLE TUBE 1
GAS MONITOR
GAS TEMP.
273
GAS TEMP.
281
GAS TEMP.
278
GAS TEMP.
276
TUBE 1
TUBE 2
TUBE 3
TUBE 4
CALCULATED GAS FLOW
4503
AIR FLOW
2250
ESA DEW POINT
38
SAMPLE TIME
10
15
SIMPLE DEW DEW POINT
37
GAS FLOW
562
SAMPLE SNAPSHOT FLOW
560
DEW POINT
38
SAMPLE TIME
10
0
GAS FLOW
563
SAMPLE SNAPSHOT FLOW
567
DEW POINT
39
SAMPLE TIME
10
6
GAS FLOW
561
SAMPLE SNAPSHOT FLOW
564
DEW POINT
37
SAMPLE TIME
10
12
GAS FLOW
564
SAMPLE SNAPSHOT FLOW
561
DEW POINT
38
SAMPLE TIME
10
18
SAMPLING
SAMPLING
SAMPLING
SAMPLING
HELP MENU
TUBE 1 SAMPLING
TUBE 2 SAMPLING
TUBE 3 SAMPLING
TUBE 4 SAMPLING
SILENCE ALARM(S)
MAIN MENU
OVERVIEW SCREEN
SAMPLING
ACTIVE ALARMS

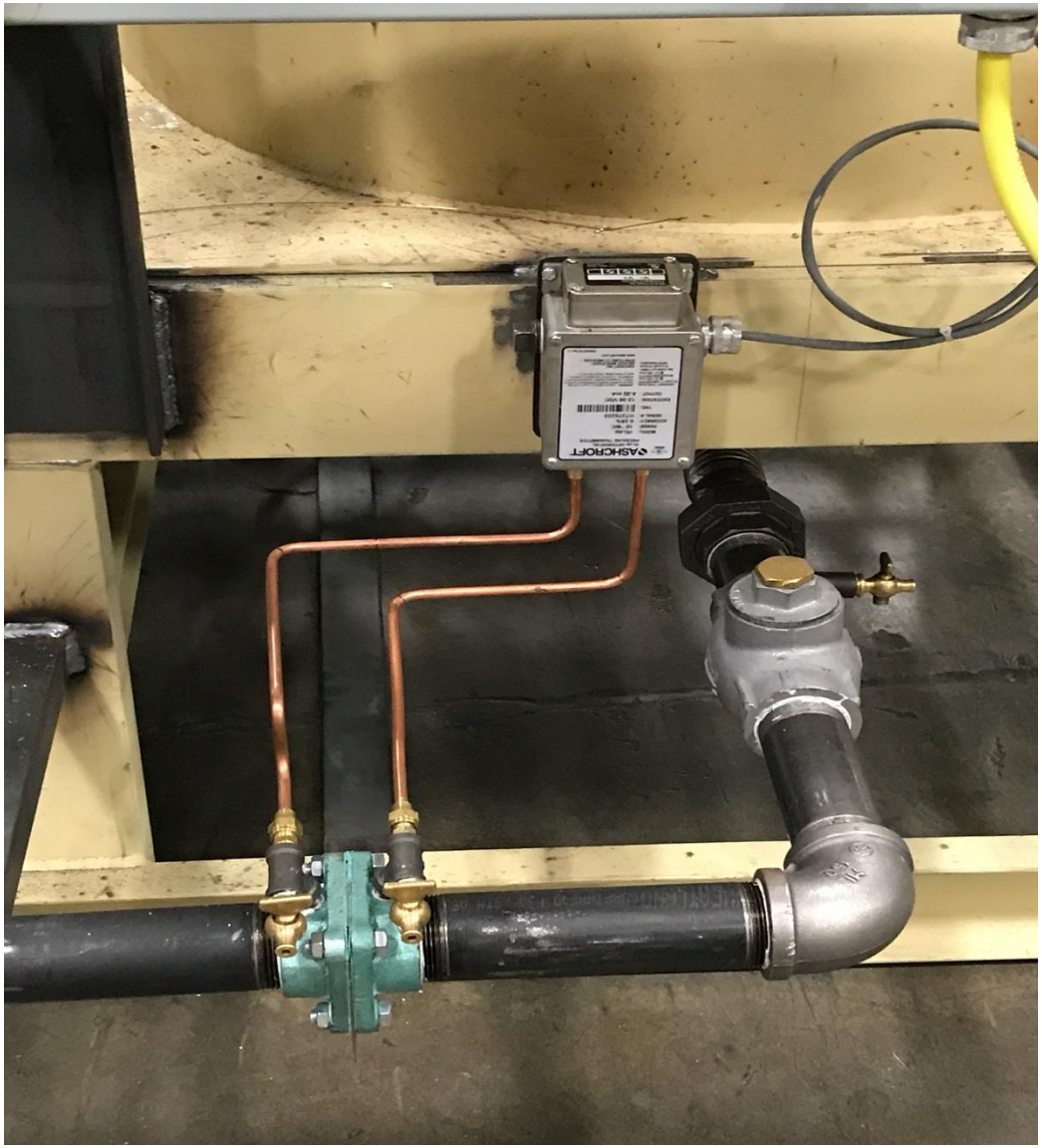
Individual Retort Dew Flow Monitoring

- **Benefits:**
  - Deviation between two (2) retort flows may indicate catalyst may need to be burned-out or changed.
  - Could also indicate interference or blocked inlet or outlet requiring attention.
  - Could eliminate scheduled burn-outs in favor of burn-outs when required.



Individual Retort Dew Flow Monitoring

- **Implementation:**
  - Each retort assembly is equipped with a metering orifice assembly with a differential pressure transmitter on the inlet side of the retort.
  - Values are compared to assure balanced flow across the number of tube on-line.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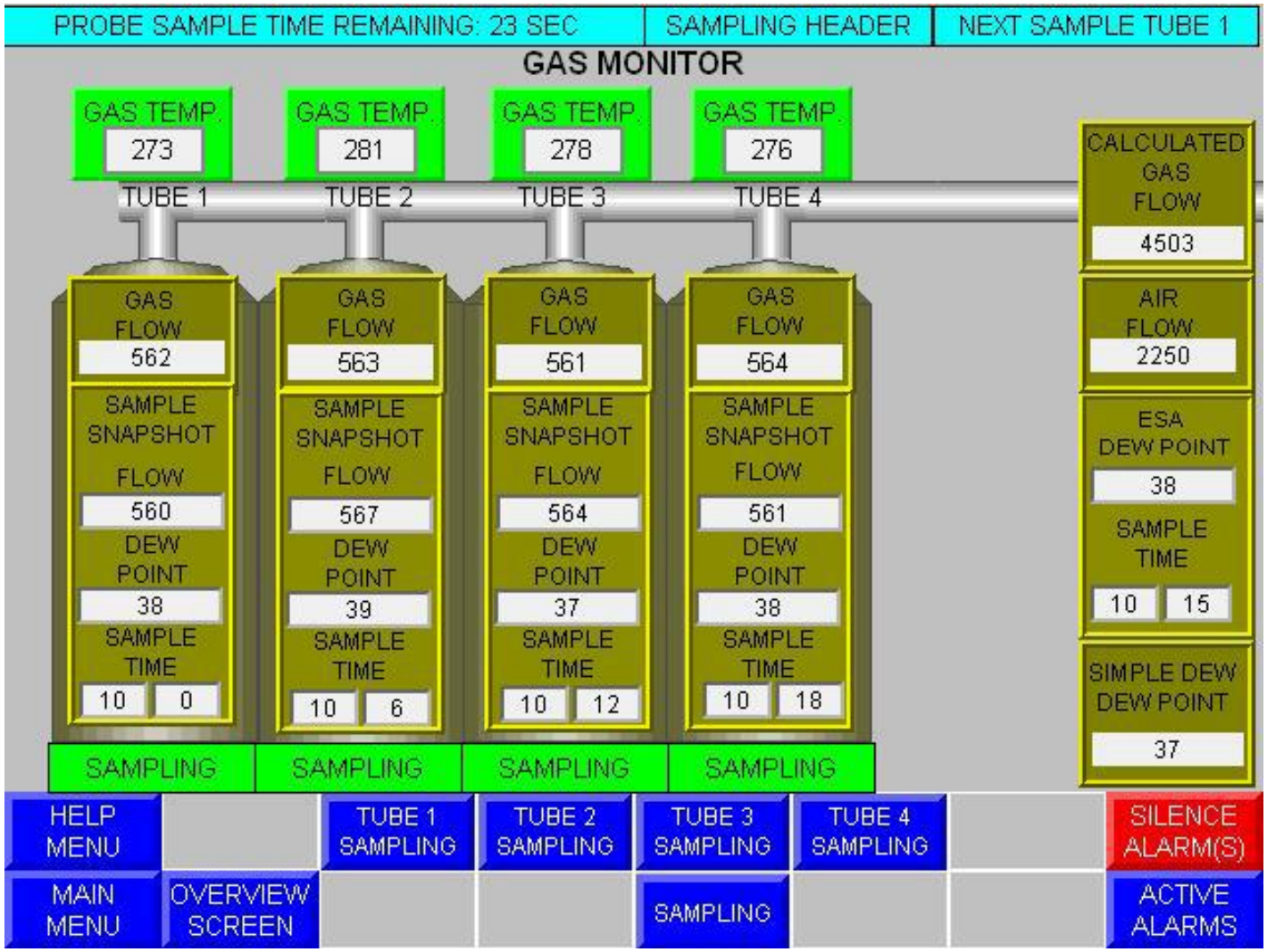
Online Retort Comparison

- **Benefits:**
  - A retort pushing through more flow than rated could result in un-cracked gas of poor quality.
  - If equipment has been shut-off and the generator is running more retorts than required, some can be shut down, saving energy costs.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SAMPLE SNAPSHOT FLOW
567
DEW POINT
39
SAMPLE TIME
10
6
GAS FLOW
561
SAMPLE SNAPSHOT FLOW
564
DEW POINT
37
SAMPLE TIME
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GAS FLOW
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SILENCE ALARM(S)
MAIN MENU
OVERVIEW SCREEN
SAMPLING
ACTIVE ALARMS

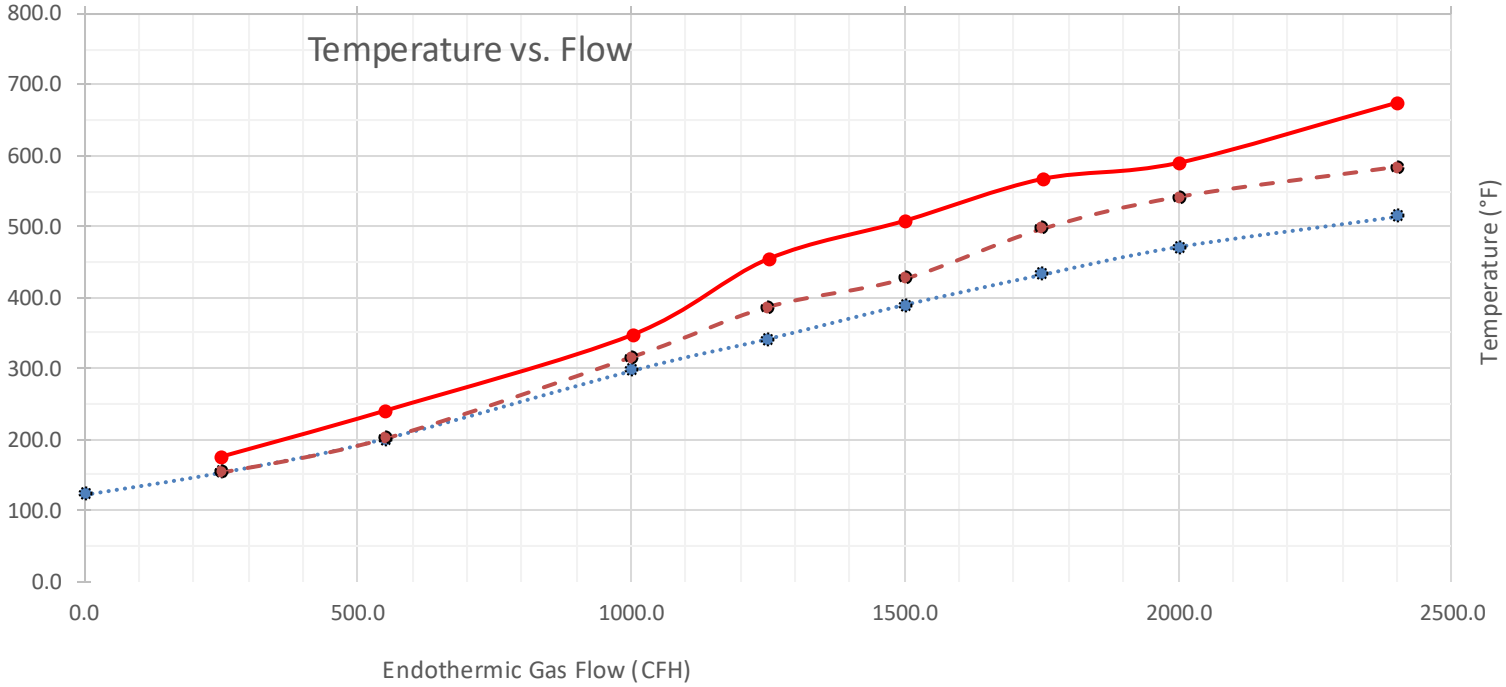
Online Retort Comparison

- **Implementation:**
  - An electronic flow meter is used in place of a standard reaction air flow meter.
  - The value of the total gas being generated vs. the number of retorts operating is compared in the PLC. If the number of retorts operating needs to be increased or reduced, the operating system will alarm.

Exit Gas Temperature Monitoring

- **Benefits:**
  - Triggers notification that air cooler filters need to be changed or cleaned.
  - Reduces the likelihood of carbon dropout occurring in endothermic gas headers to equipment.
  - Reduce downtime and header cleaning fees.

Blocked Filter Effect on Exit Gas Temperature



Dotted Line = Clean Filter
Dashed Line = Filter ½ Blocked
Solid Line = Blocked Filter

Exit Gas Temperature Monitoring

- **Implementation:**
  - Each retort outlet is equipped with a type K thermocouple.
  - Values are compared and alarmed against a configurable value in the PLC.

Thank you!
Any Questions?

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