PROCESS GAS SAMPLING SYSTEMS
Sample conditioning system

- System functions
- How it works
- Key components
- Design and layout
- Pre-conditioning components
- Custom solutions
System functions

- To transport clean sample gas to the sensor
- To condition the sample so it is compatible with the sensor
- To switch from one stream to another
- To allow for proper calibration
- To return the sample back to the process or to disposal
- To allow for the effects of corrosion and other reactions
How it works, Configuration #1

- Positive pressure-driven sampler
  - Process pressure pushes the sample to the sensor
  - For process operating pressures ≥ 5 psig
  - A pressure reducing regulator controls the pressure and flow through the system
How it works, Configuration #2

- Aspirator-driven sampler
  - Uses air or nitrogen as a drive gas to draw the sample to the sensor
  - Intrinsically safe aspirator with no moving parts
  - For process operating pressures: -25" WC to +5 psig
How it works, Configuration #3

- **Vacuum pump-driven sampler**
  - Used when no compressed gas is available or when running at high vacuum
  - Separate vacuum pump draws sample to the sensor
  - For process operating pressures > 25"
Eductor

- No moving parts
- Produces vacuum by means of the Venturi effect
- Uses air or N2 as a drive gas to draw the sample to the sensor

Drive gas inlet (5 psig)

Stainless Steel nozzle

Sample inlet (negative pressure port)

Exhaust/outlet
Vapor Condenser

- Air-cooled heat exchanger
- Designed to cool the sample gas and remove vapors and condensate
- Splits the gas flow into a sample flow and a bypass flow
Vortex cooler assembly

- Provides refrigeration
- Splits the air flow into a cold stream and a hot stream
- Temperature drop of 20 to 30° F
- No moving parts
Vortex drive
gas inlet

Cold end

Hot end

Vortex hot
gas exhaust
flow meter (100 ccm)

sample gas from vapor condenser

selector valve for sample gas or CAL gas

sample gas in

sample gas out

O2 sensor connection
Inline filter (F Series)

- Filters debris from sample gas line
- Replaceable sintered metal element
- 90 micron pore size
Flow (Reed) Switch

- Provides alarm for inadequate flow
- Intrinsically safe
- Contacts open when flow falls below the preset level
- Setpoints: 1.8/1.0
  - Ascending, 1.8 slm
  - Descending, 1.0 slm
- Teflon float with magnet
Flow switch

reed switch assembly
Coalescing prefilter

- Provides particulate and mist removal
- Vertically mounted at a low point in the sample line
- For positive pressure apps – include a drip leg and restrictor valve
- For vacuum apps – include an autodrain
Coalescing prefilter

- **Solvent-based**
  - **Inside-out flow direction**
    - Inlet → port #1
    - Outlet → port #2

- **Powder-based**
  - **Outside-in**
    - Inlet → port #2
    - Outlet → port #1

Port #1
½" FNPT

Port #2
½" FNPT

Filter cartridge

Drain bowl

Mounting bracket

Drain port

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Liquid trap

- Removes accumulated liquids and droplets
- Minimizes sample stream pressure drop
- For positive pressure apps – use with restrictor valve
- For vacuum apps – use with autodrain
Water spray scrubber

- Continuously removes soluble contaminants and corrosives
- Available in corrosion resistant materials (Kynar or Stainless Steel)
Water spray scrubber
Sample prefilter, liquid trap, or spray scrubber

Install autodrain 5’ (60”) below sample line
Negative pressure autodrain

- Reduces maintenance by continuously draining liquids from sampling components
- Prevents ambient air from contaminating the sample
Water cooled demister

- Removes solvent droplets, mists and vapors from the sample stream and returns them to the process vessel.
- Counter-flow, water-cooled jacket lowers sample temperature and aids in solvent removal.
Bubble scrubber

- Removes soluble contaminants and corrosives
- Kynar/Teflon or Stainless Steel MOC
- Scrubbing media (water or neutralizing liquid) requires periodic maintenance
- Vertically mounted
Blowback prefilter

- For powder handling
- Continuously removes large quantities of particulates
- Kynar/Hastelloy C or Stainless Steel MOC
- Removal rating: nominal 0.4m
- Solenoid valve required for blowback mode – pulses air from opposite direction

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