Grab Sampling Systems

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Introduction Swagelok

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Field Engineer / Trainer

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Sales Engineer

What is Grab Sampling?

- Collection of a sample of fluid in a pipeline, tank, or system
- Sample is transported to laboratory for analysis
- Many different types in two broad categories:
    - Cylinder panels
    - Bottle panels

Grab Sampling in Processes

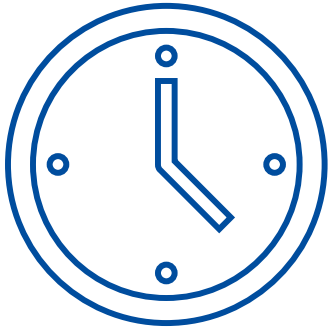
Why Grab Sampling?

- Validation
- Reference sample of sold product
- Evaluation of environmental emissions according to local regulations

Grab Sampling Systems Advantages

Improve Safety

Representative



Timely

Quality

Grab Sampling System Design Considerations

“Flush” Time

- Deadhead volume trapped in transport line and grab sample system must be flushed!
- Flush time $t = \frac{Volume_{transport\ line} + Volume_{grab\ sample\ system}}{Flow\ Rate}$

Basic Rules Sampling

Representative

- The sample must be the same as the process
- Pure & Fresh sample, do not contaminate the sample
- Avoid phase changes
- Use probes to sample from middle 1/3 of pipe
- Repeatable

Grab Sampling System Design Considerations

Dead Legs

- Each dead leg causes about 1% of cumulative contamination (Gas)

Figure 1156 – CFD Gas Response & Dead Legs

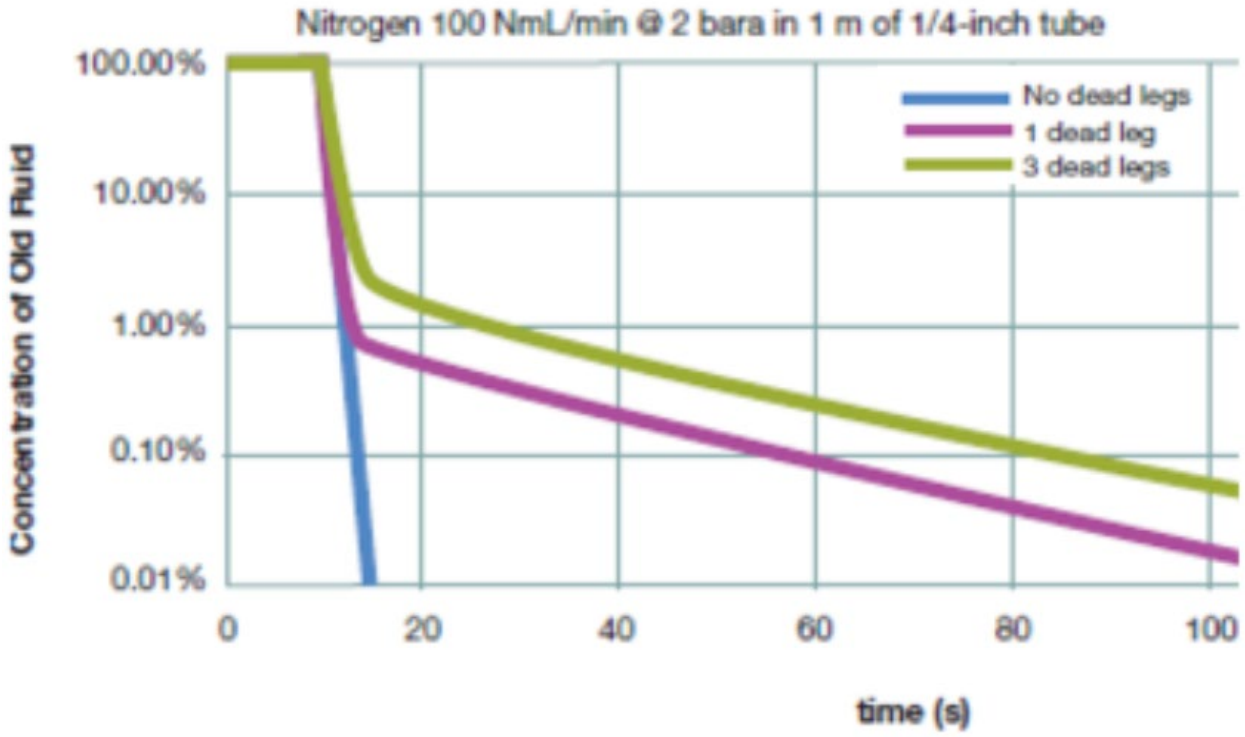
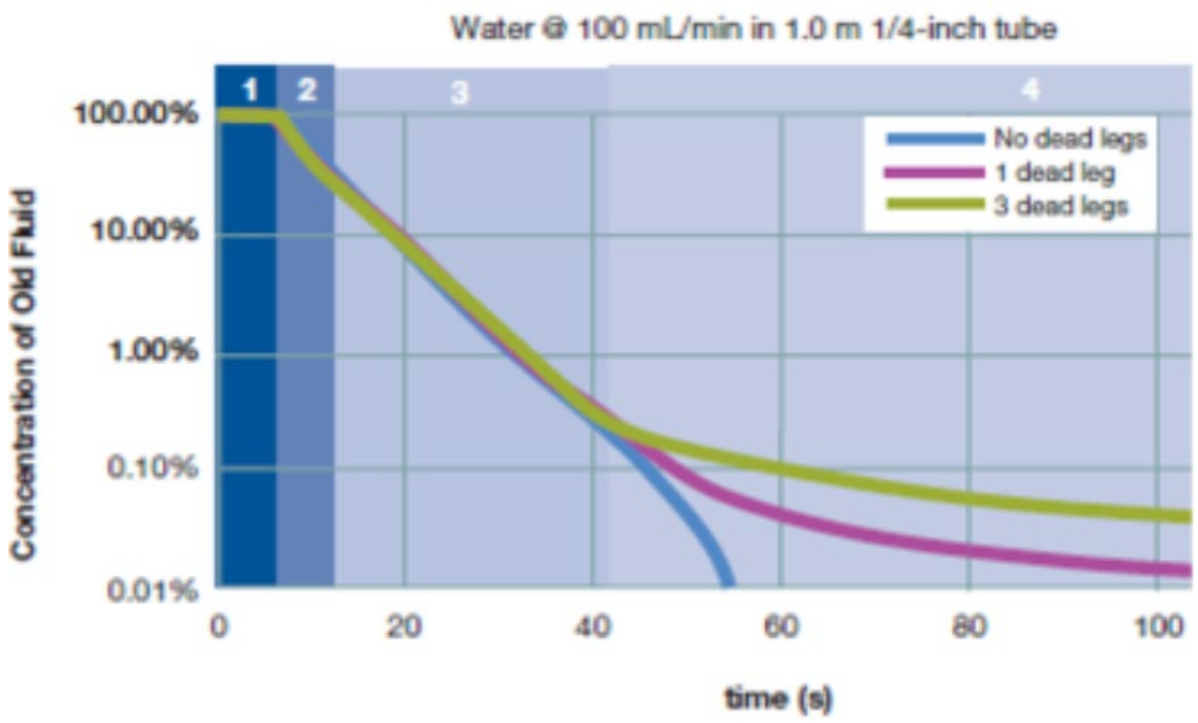


Figure 1155 – CFD Liquid Response & Dead Legs

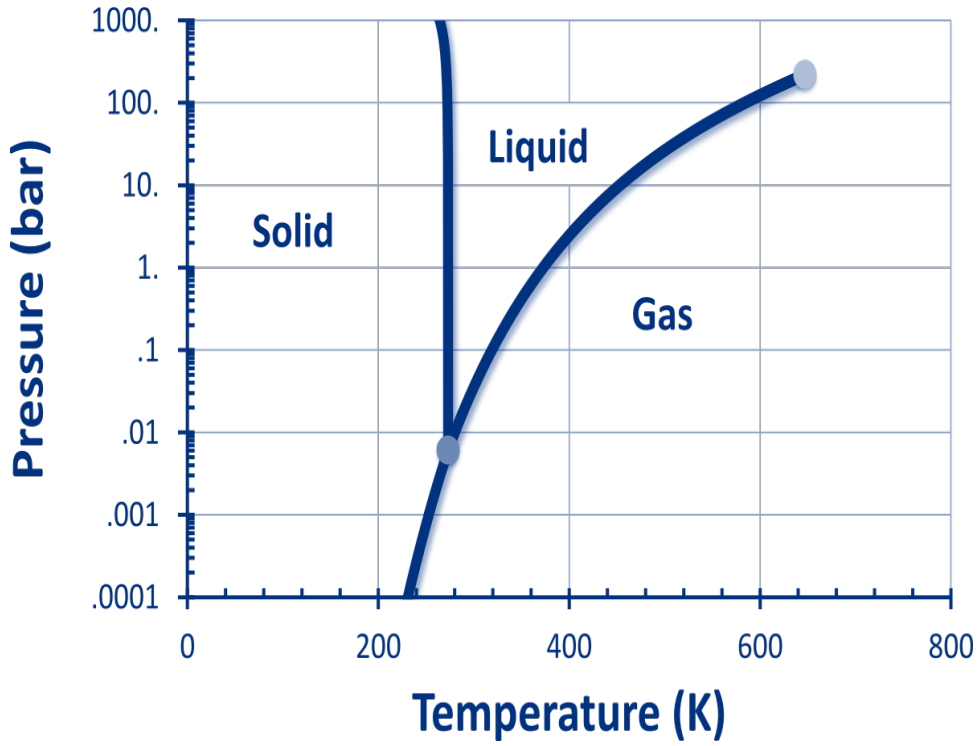


Behavior of Samples

- Pressure / Temperature changes can affect the sample:
  - ***Temperature*** ↑ ***or Pressure*** ↓

    Lighter components will boil (vaporize)
  - ***Temperature*** ↓ ***or Pressure*** ↑

    Heavier components will condense out of gas samples before the lighter ones



- Avoid phase change – it will change the composition of the sample
- Maintain the sample at process conditions if possible

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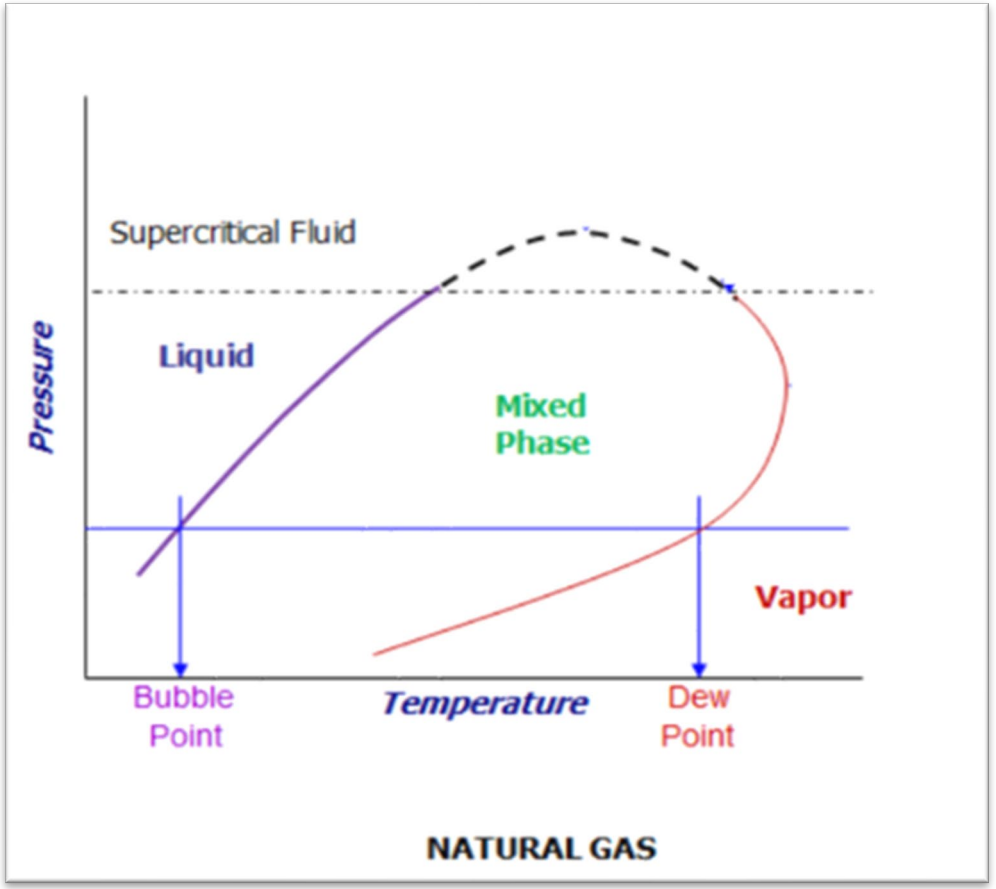

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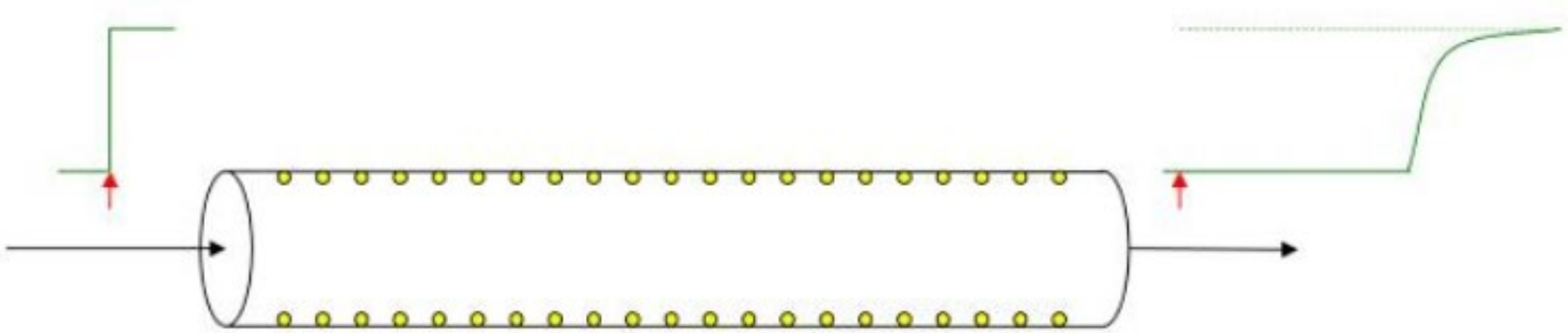
Adsorption

Sticky Molecules

- Molecules like Hydrogen Sulfide and Water are strongly attracted to a surface and are difficult to wash off:
  - Adsorption of polar molecules causes an unpredictable result
  - Or even complete removal of the analyzed molecules



Sample Cylinder Coatings

PTFE Coating

- Nonstick surface, which aids in cleaning

Electropolishing

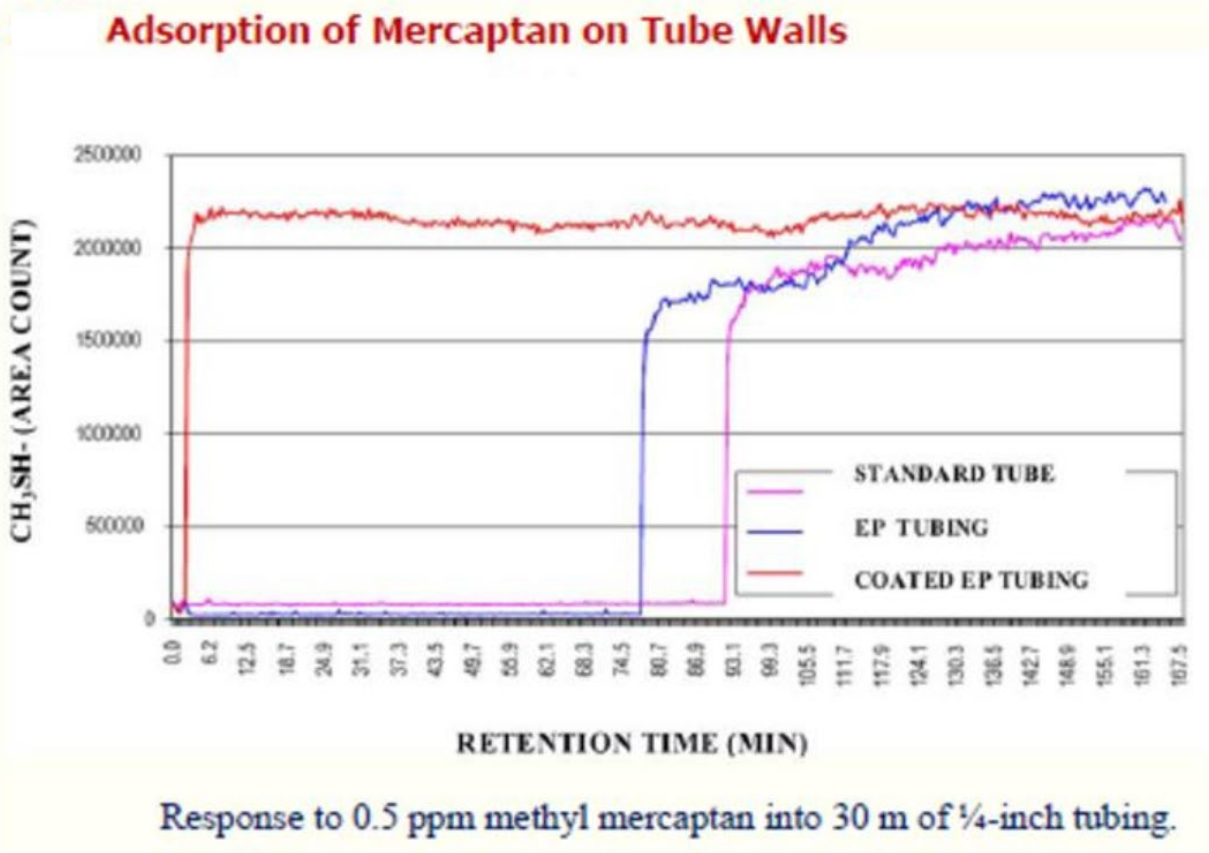
- Provides a clean internal surface

Silconert Coating

- Inert to avoid adsorbing or reacting with the sample

Dursan Coating

- Achieve corrosive performance similar to exotic materials

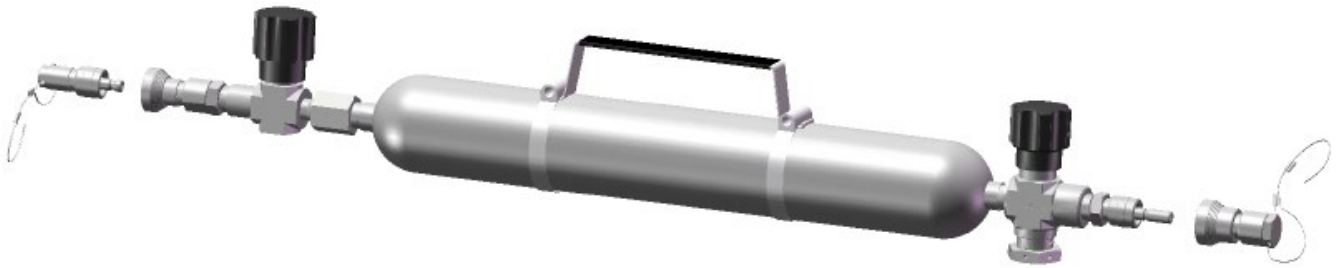


Response to 0.5 ppm methyl mercaptan into 30 m of ¼-inch tubing.

Sample Container Selection

How to select the type of system and sample container?

- Use a sample cylinder for gases and volatile liquids
- Toxicity
- Sample pressure

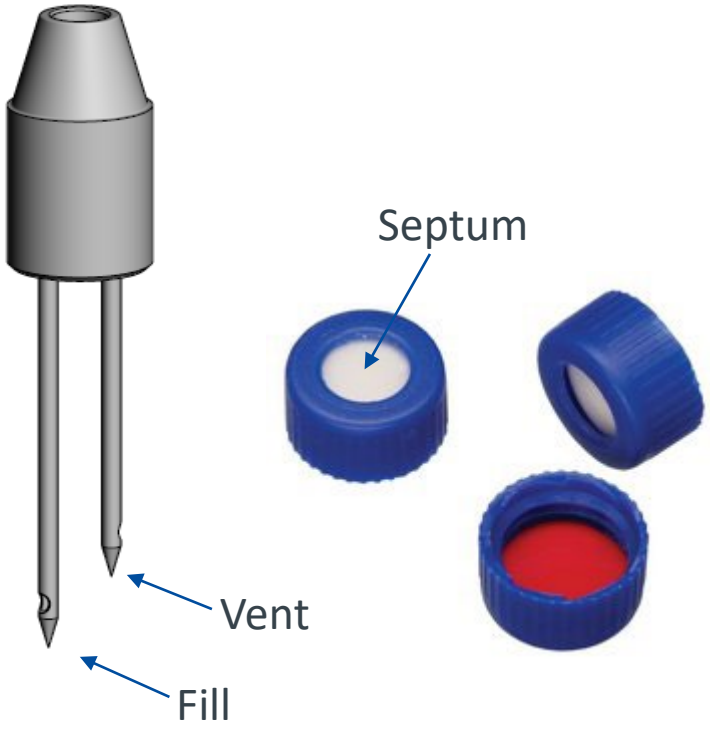


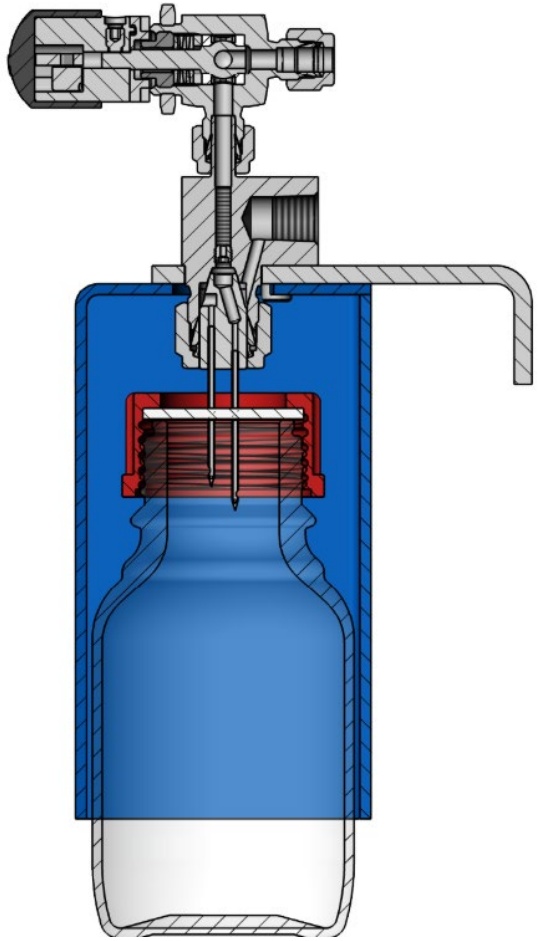
Bottles can be used for *nonvolatile* liquids

- Maximum vapor pressure of 1 bar at ambient conditions

Best Practices – Bottle Sampling

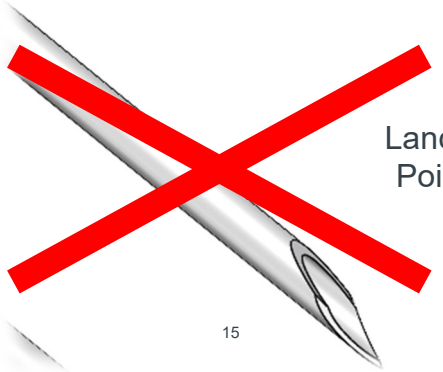
- Side ported fill and vent needles for use with a septum
- Use shroud to guide bottle into needles
    - Reduces risk of bending needles

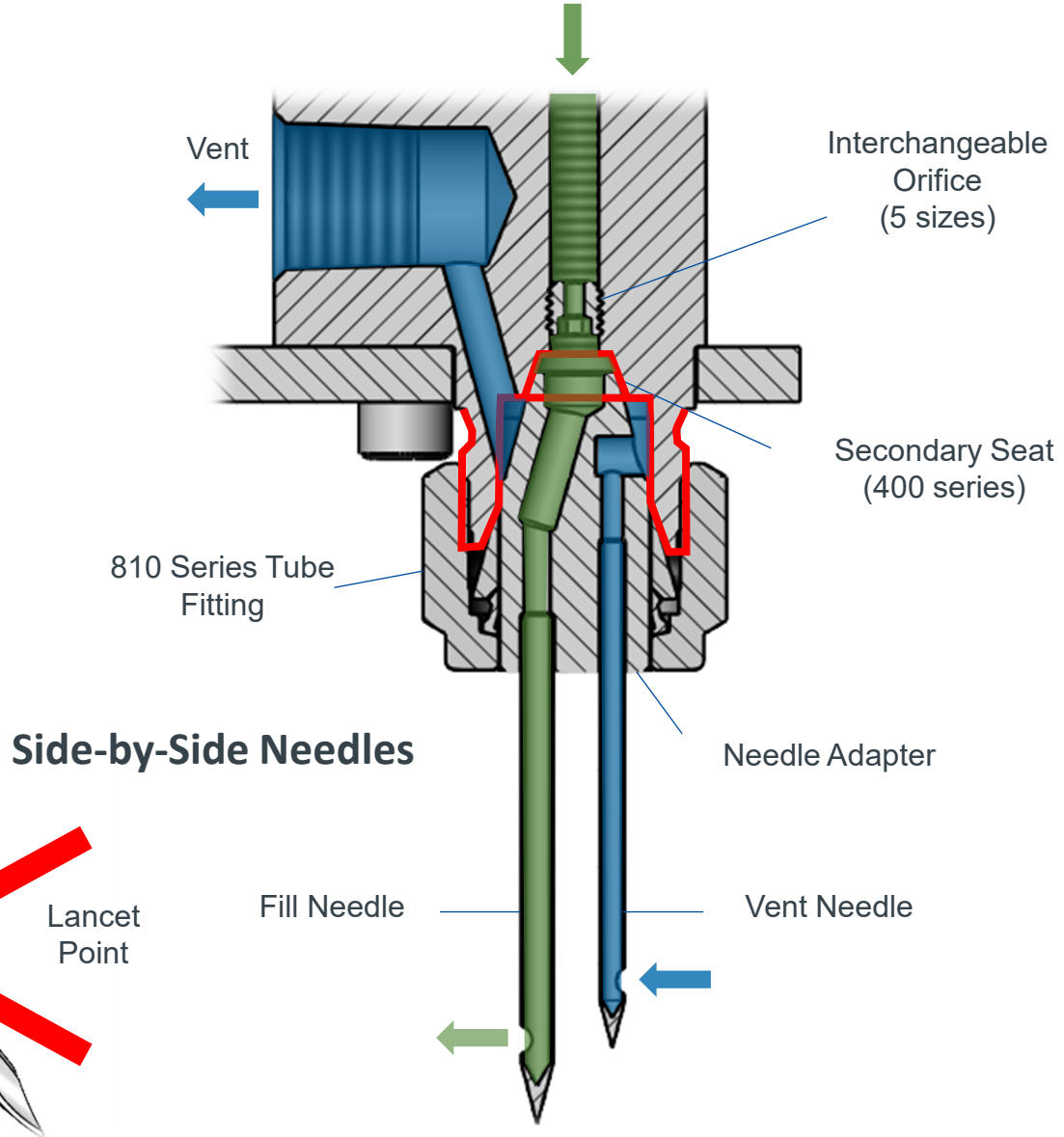




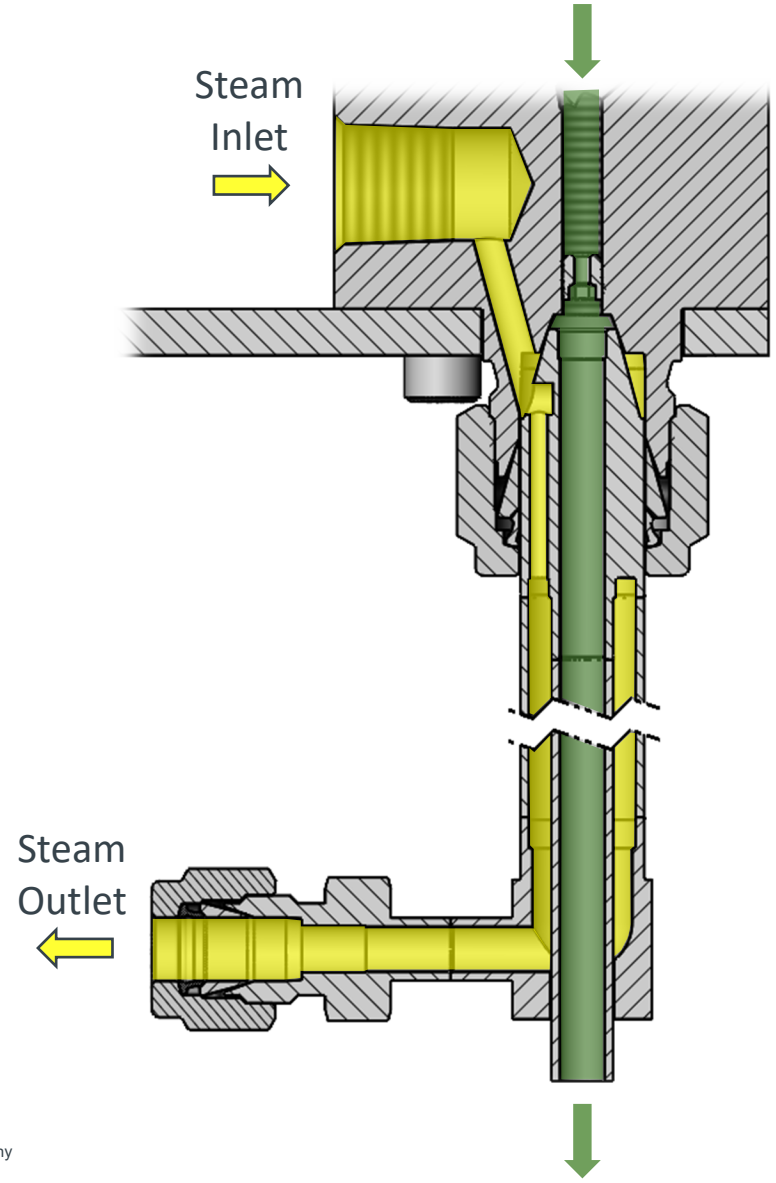
GSV – Needle Assembly

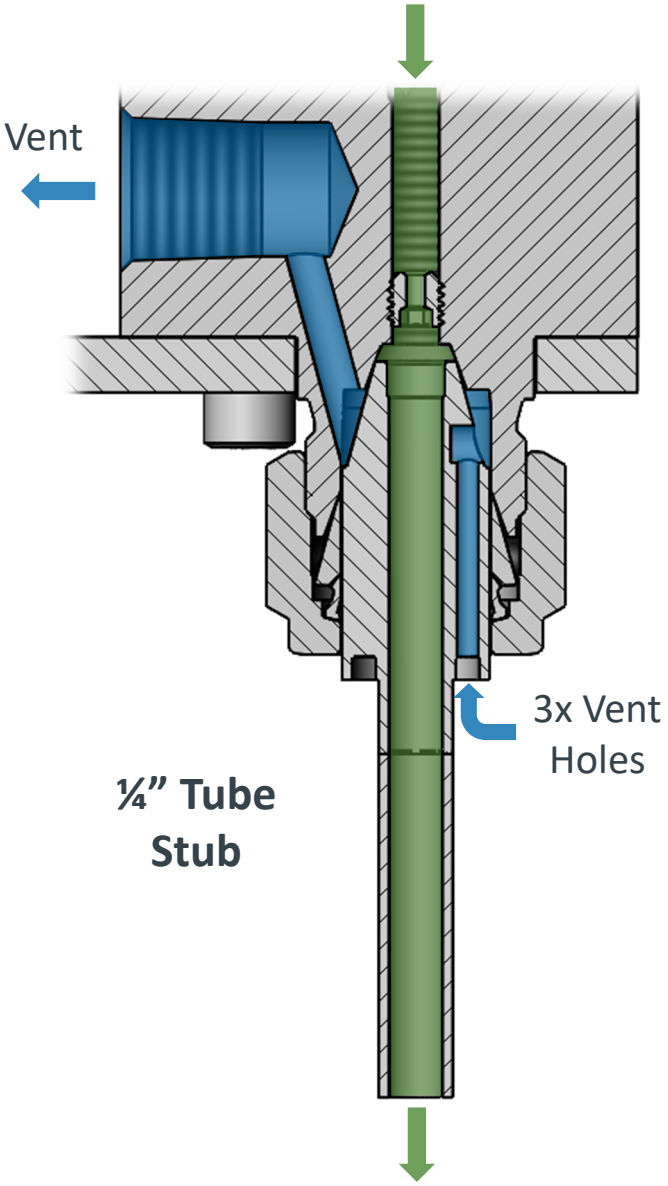
- Uses Swagelok tube fitting technology
  - ½” tube fitting swages onto OD of adapter
  - Adapter nose = ¼” port connector – seals on secondary seat
  - **1**-turn installation
- Replaceable
- Rotatable – orientation not critical
- No elastomers
- Pencil point needle design



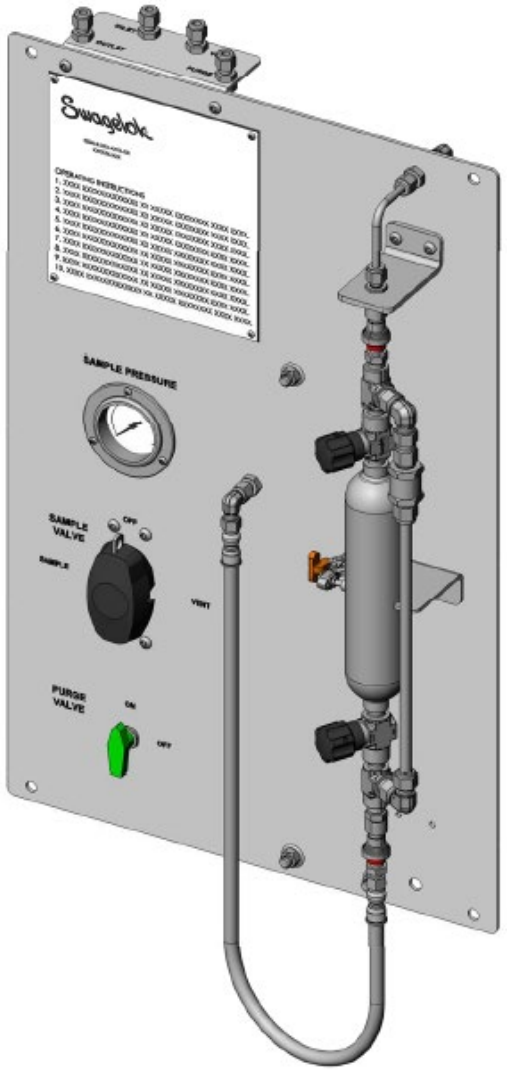


GSV – Needle Assembly Alternative Configurations

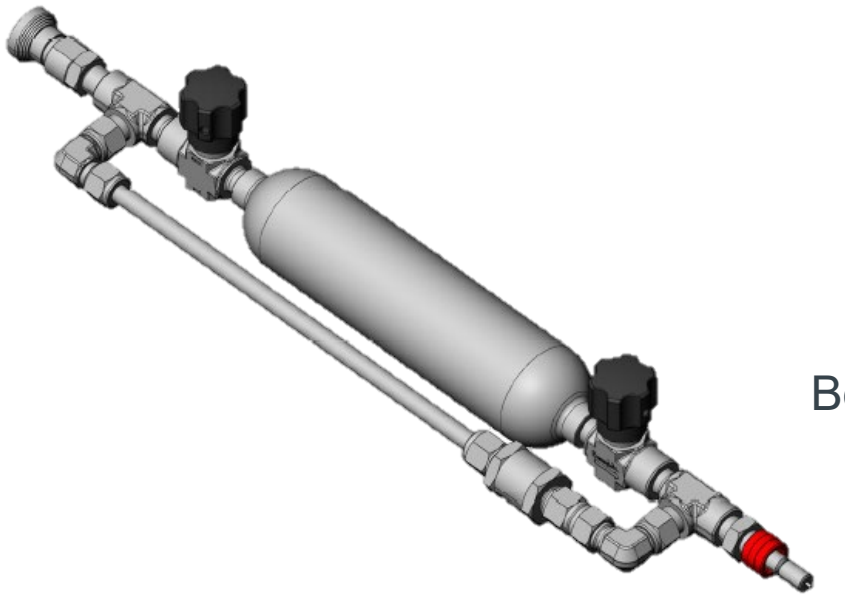




Standard Grab Sample Panels



Cylinder Style Panels



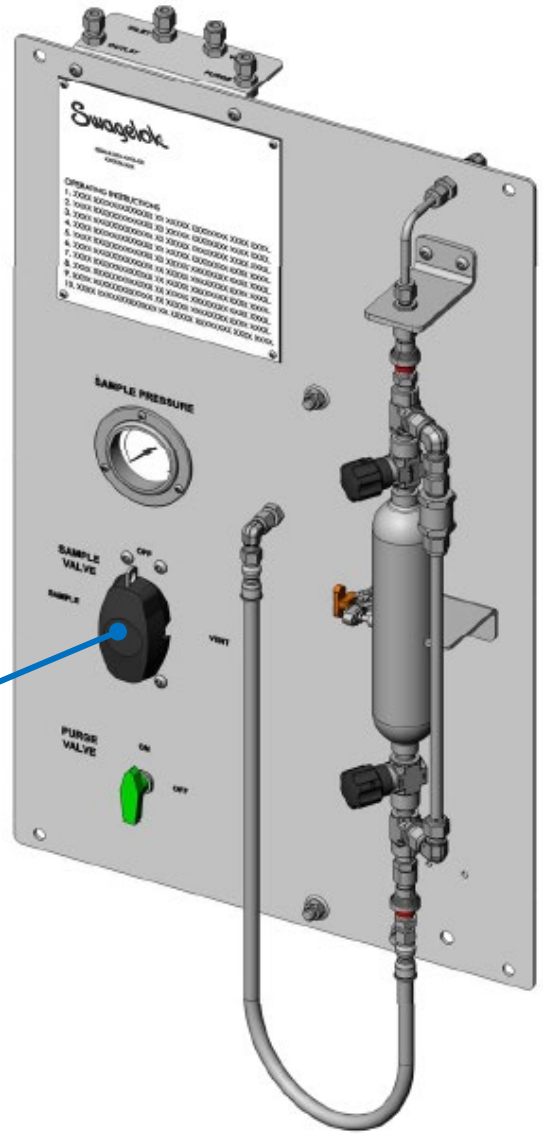
Bottle-Style Panels

Geared Valve Assemblies

2-Valve Switching Valve

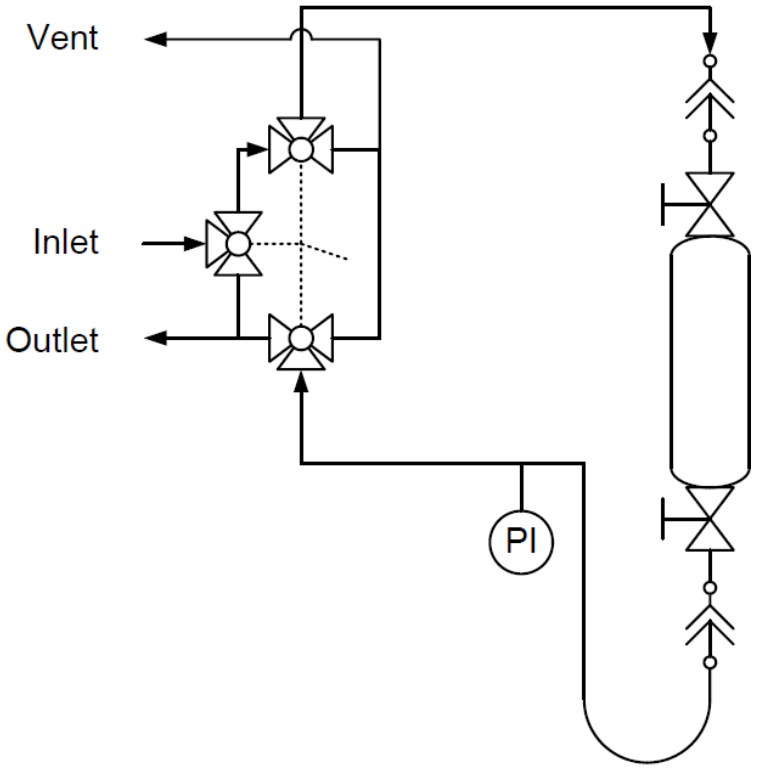
3-Valve Switching Valve

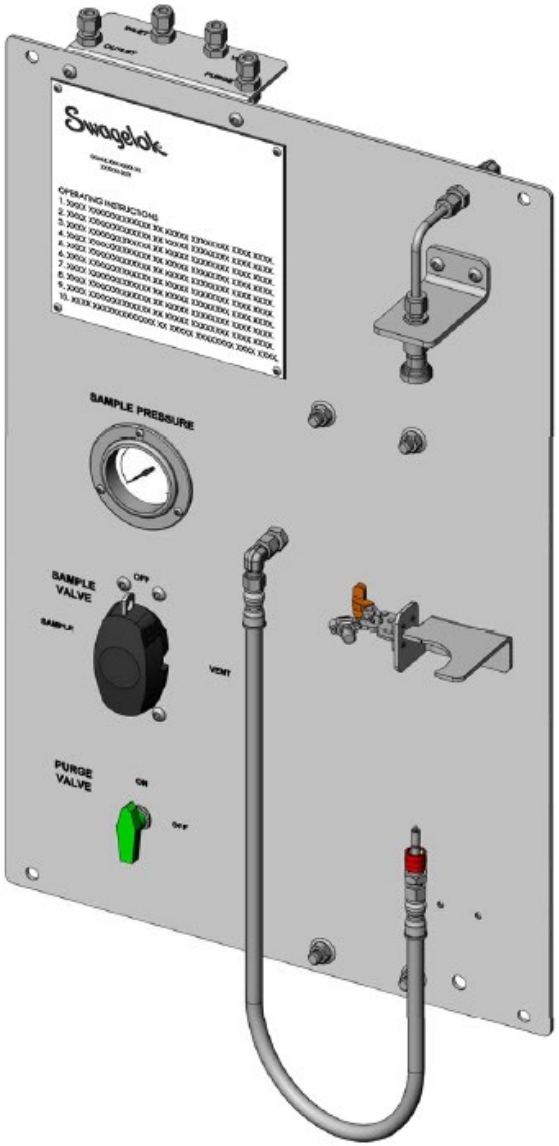
- **Handle <u>Positions</u>**
  - Sample
    - Off
    - Vent

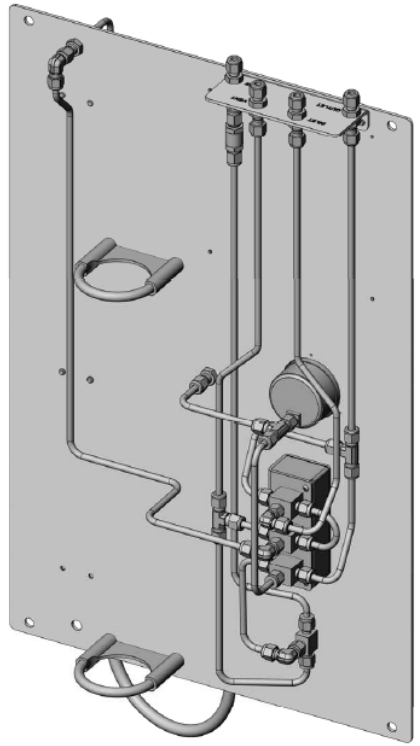


GSM – Continuous Flow

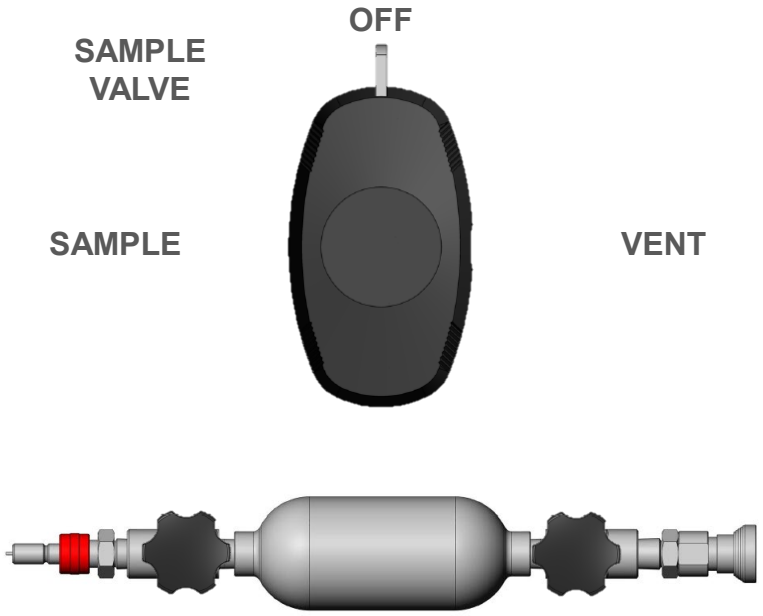
- Continuous flow from inlet to outlet
- Typical uses:
- Fast Loop Sampling

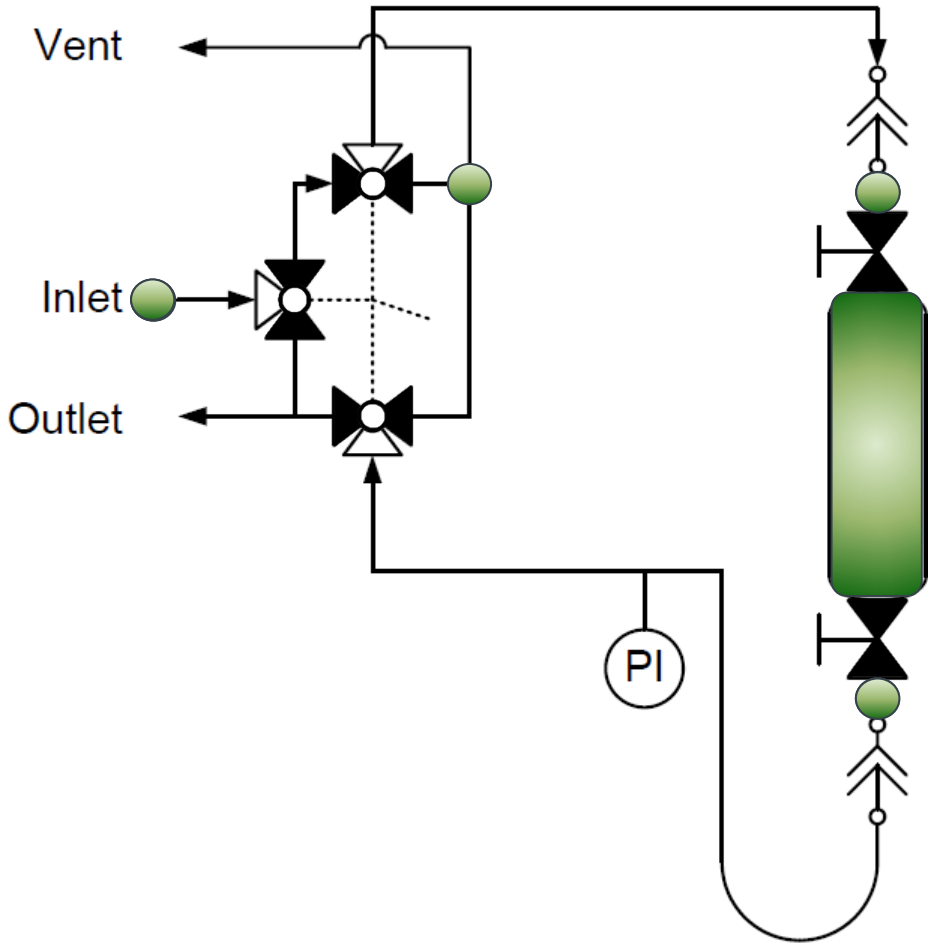




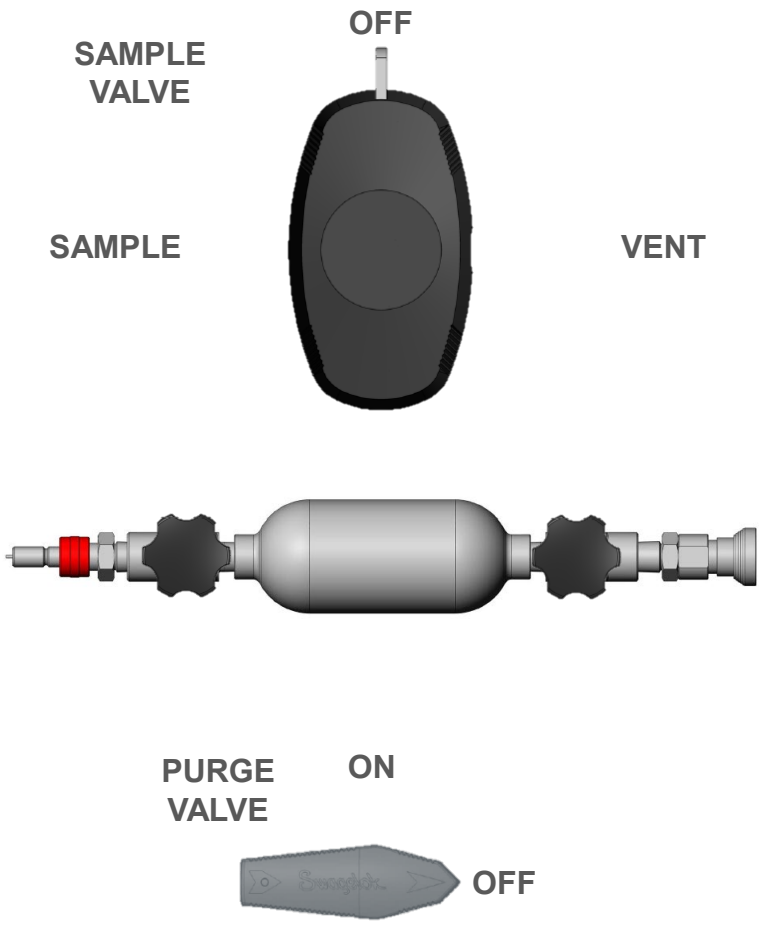


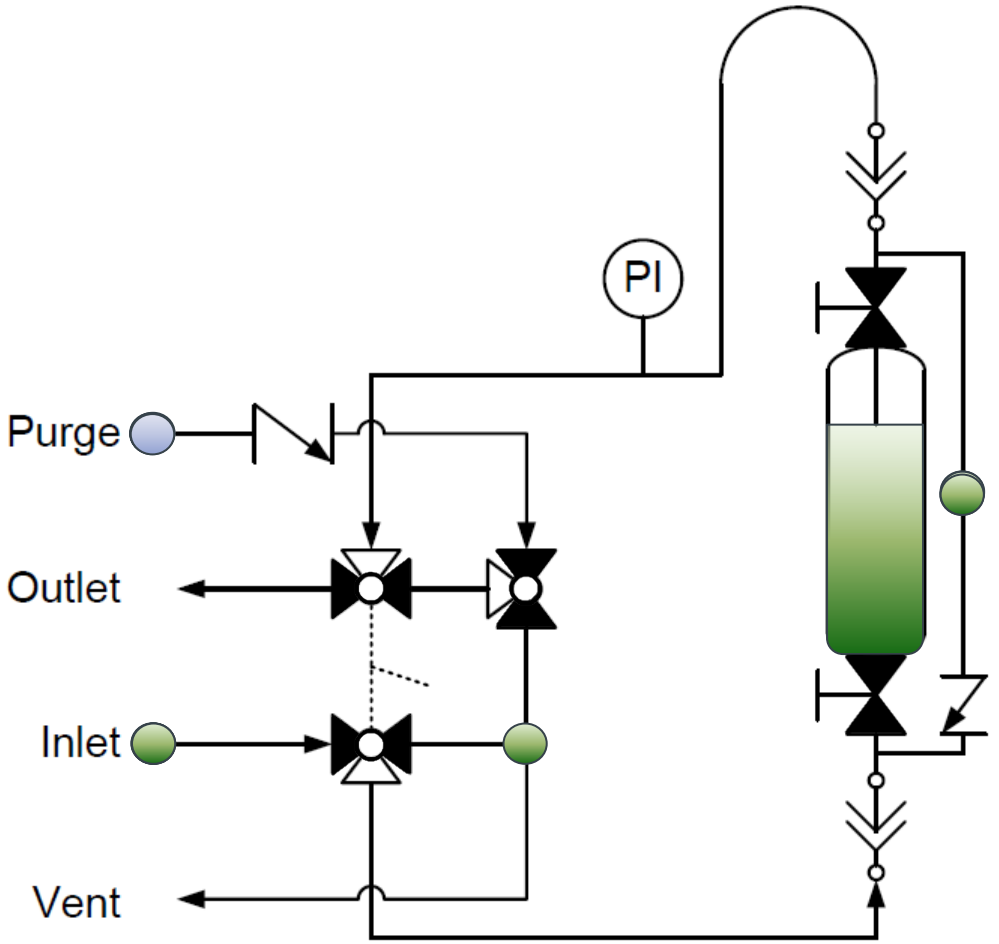
Continuous Flow (Gas)





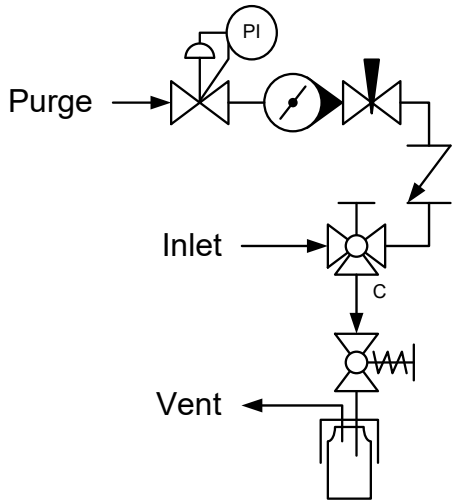
Standard (Liquid with Purge Option)

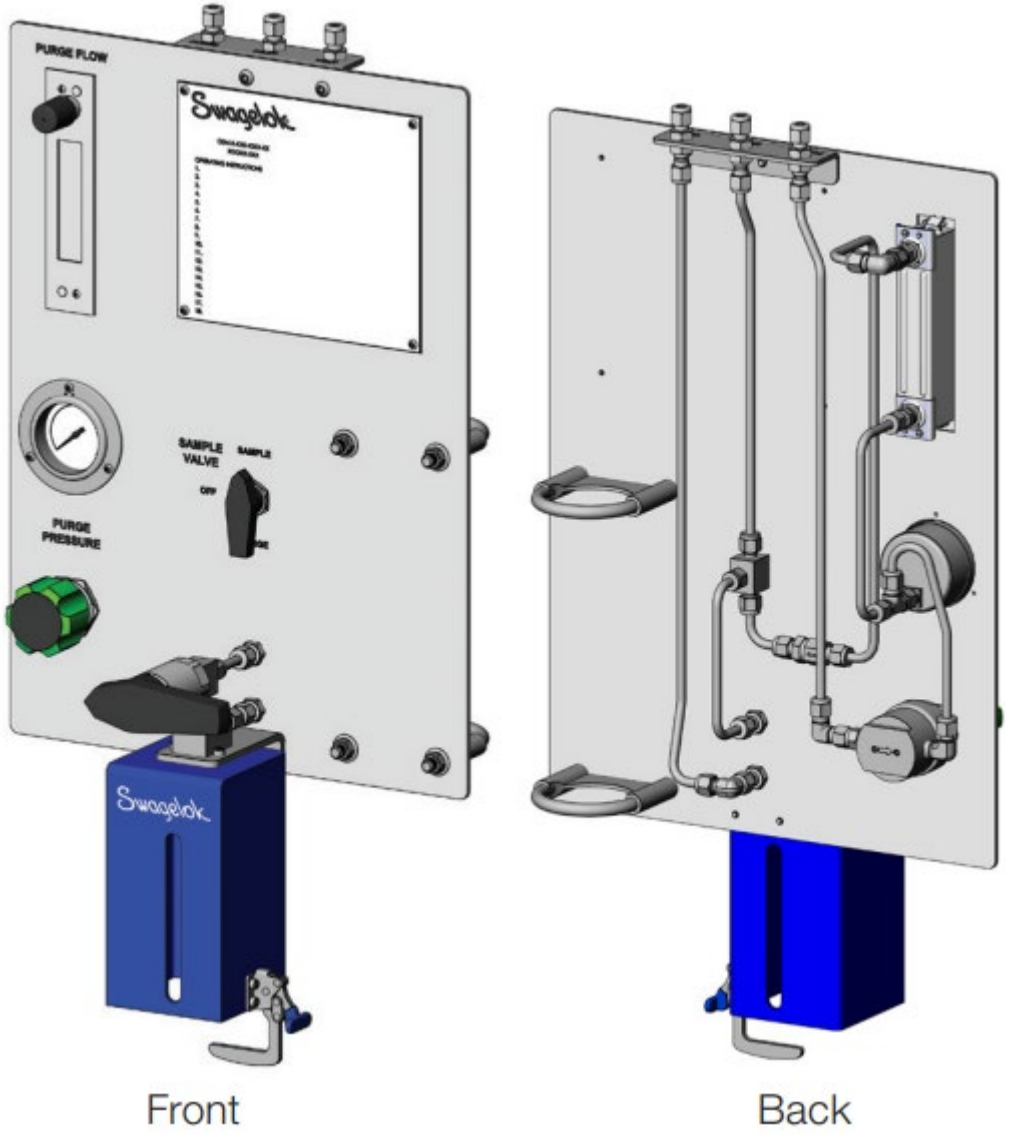




GSL – Simple with Purge

- Added purge
  - Clean needle
  - Sample integrity
- Typical uses:
  - Direct pipeline sampling





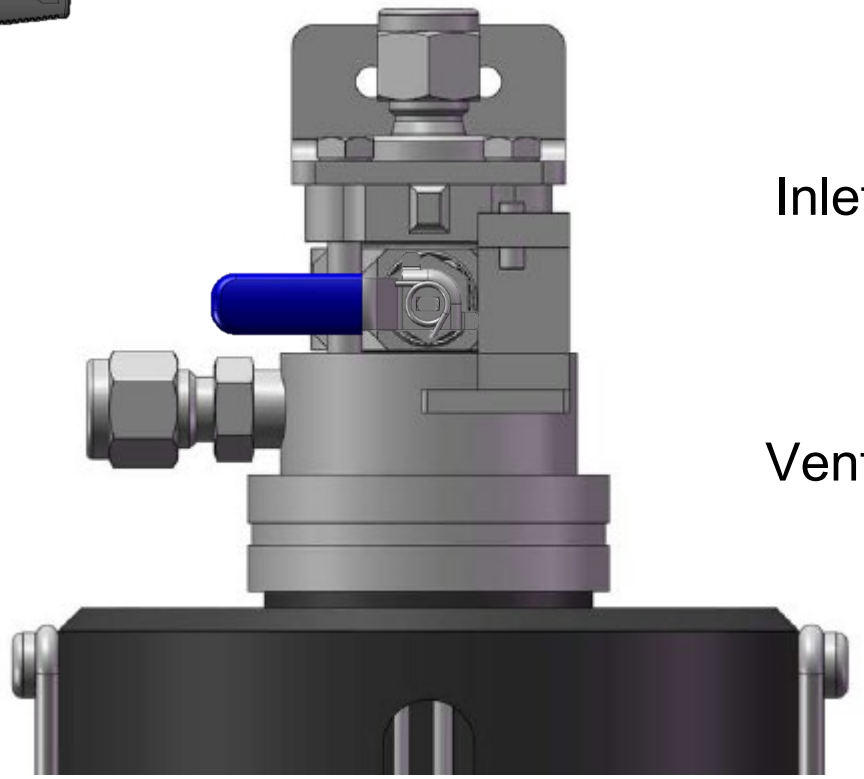
Sample with Purge

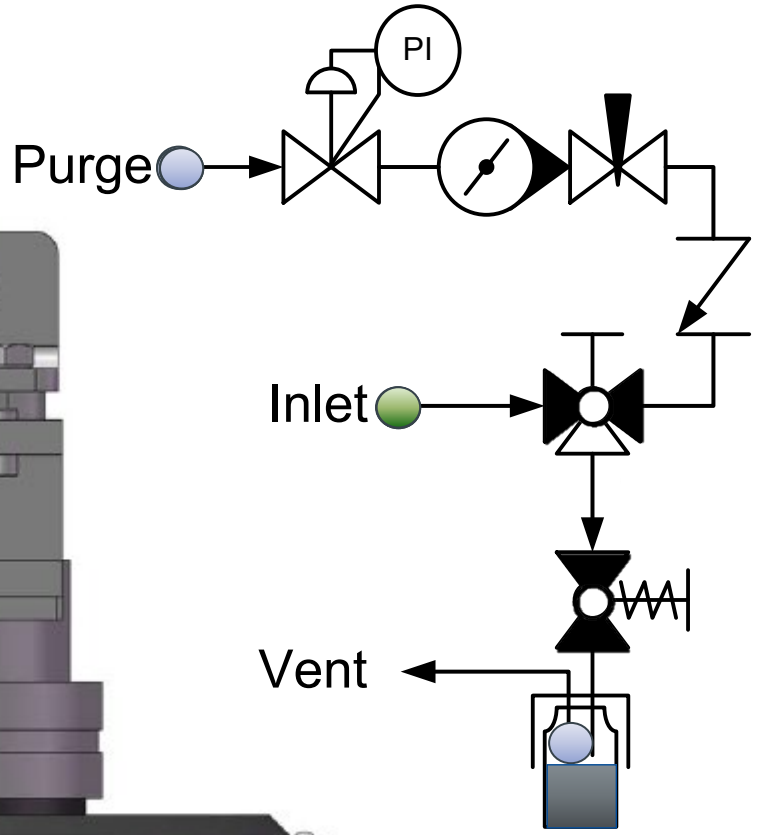
SAMPLE VALVE

SAMPLE

OFF

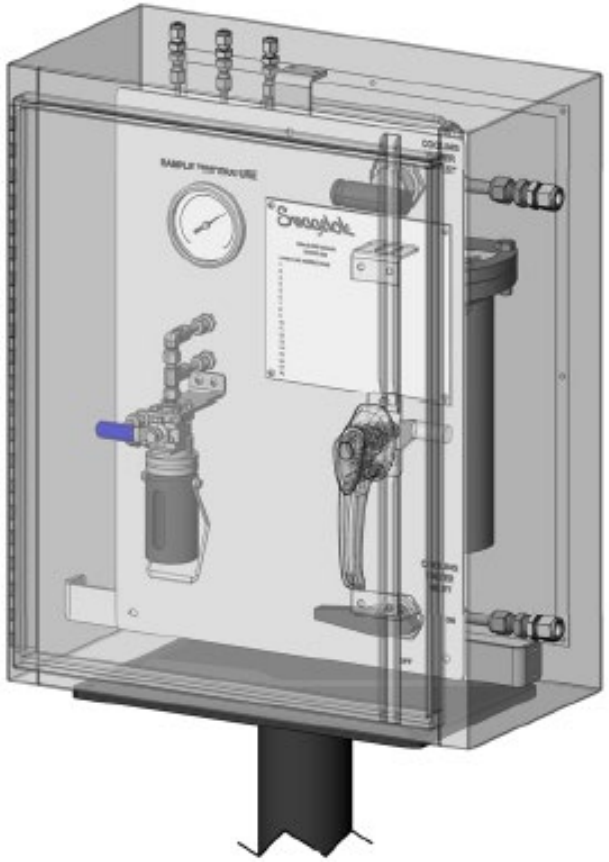
PURGE

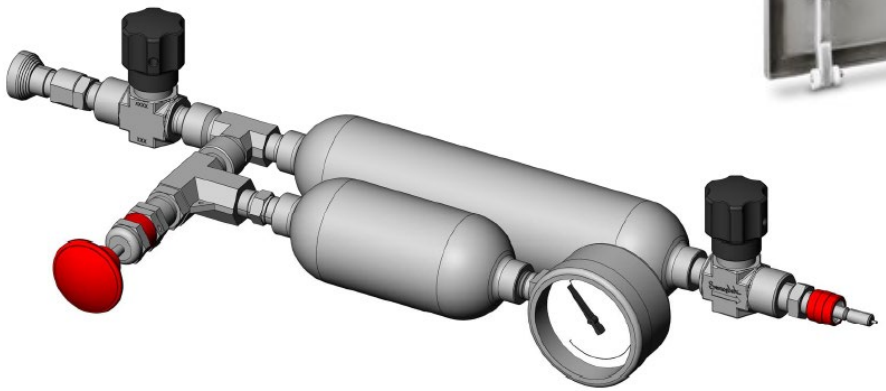




Grab Sample Panels – A Design Platform

Customization options





Sampling System Training 2023

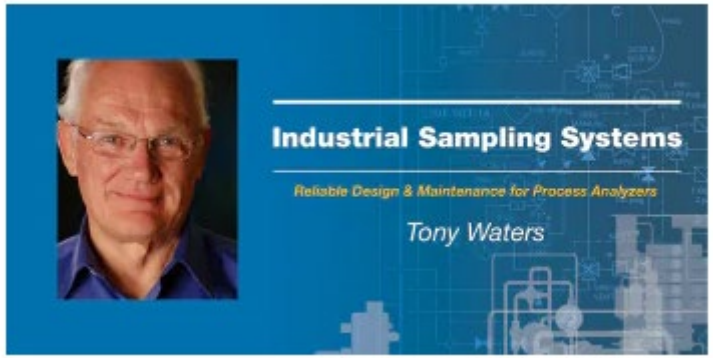
Process Analyzer Sampling System (PASS) Subsystems

Sharpen your design skills by breaking sampling systems down into subsystems and their discrete function blocks to **learn how each subsystem impacts analyzer results**.

Sampling System Problem Solving and Maintenance (SSM)

Learn how to **troubleshoot a variety of common and complex design issues** from the process line through sample disposal.

- Classroom in Waddinxveen
- Course content is derived from technical reference book: Industrial Sampling Systems



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