Gas and Liquid Sampling

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Training Goal

- Review basic terminology and standards
- Provide basic understanding and offerings of the low emissions (Low-E) manual samplers
- Understand the Low-E competitors
- Understand basic applications where these samplers are used

Oil Refinery 1856

Oil Refinery – 1930's

Shell Martinez Refinery - California

Refinery Today

OMV - Austria

Petrochemical Plant

Glycol Plant - Japan

Pharmaceutical

Chemical

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Eastman Chemical

NACE

- Oversees technical committees
- Researches, studies and provides standards and recommend technologies for the reduction and prevention of corrosion
- SEC involvement with NACE is primarily related to the petroleum production and refining industries dealing with sour liquids and gases
  - The term “sour” relates to the presence of H_2S (hydrogen sulfide) in the process stream.

What is NACE?

- Established in 1943
- Initially NACE's primary focus was Cathodic Protection (CP) of pipelines
- Originally known as the National Association of Corrosion Engineers

Scope

- Oil and gas production
- Chemical processing
- Refining
- Protective coatings and linings
- Chemical treatment
- Water systems
- Materials selection and design

What does this mean to Sentry?

- We make products that sample corrosive materials
- Our samplers are sometimes in environments that are corrosive.
- Example: oil production and refining

NACE Standards

- MR0175/ISO 15156:2003
- MR0103-2005
- MR0175/ISO 15156:2003
  - Oil and gas production
- MR0103-2005
  - Refineries
- Sulfide Stress Cracking (SSC)

Considerations

- Chemical composition of metal
- Heat treatment
- Microstructure
- Hardness

Silcosteel® and Sulfinert®

- Sulfinert®
  - A required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds.
- Siltek®
  - The ultimate passivation for treated components, from glass to high nickel alloys of steel.
- SilcoSteel®
  - A general-purpose passivation layer for steel and stainless steel.
- SilcoSteel CR®
  - A corrosion resistant layer that increases the lifetime of system components in acidic environments containing hydrochloric, nitric, or sulfuric acid, or seawater.

Goals of Closed Loop/Low Emissions Sampling

- Safe, simple, and accurate means of sampling
- Representative sample
- Reduce volume of sample used/wasted
- Reduce vapor hazards to operator taking sample. (OSHA)
- Reduce fugitive emissions from the sampling process. (EPA)

Definitions

- CONTEMPORARY SAMPLE: Taking of a fresh Sample that keeps flowing through the system at all times. It must not lay dormant in the pipe before sampling
- LOW EMISSIONS (Low-E): Taking of the sample with minimal release of liquids and/or vapors to the environment
- CLOSED LOOP: Recirculation of process gas/liquid through the sampler continuously
  - Also known as a Speed Loop, Sample Return
  - Process remains “closed” at all times

Low-E Samplers

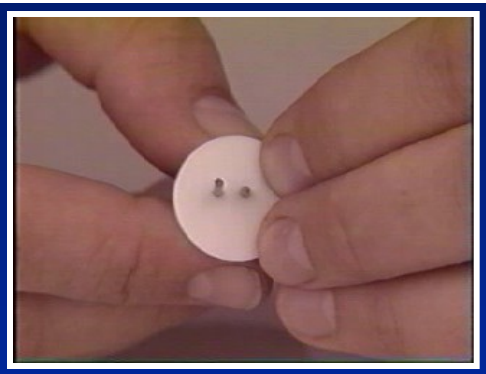
- Needle Samplers (Liquid State)
  - Closed Loop Needle - MVD
  - Inline - MIL
  - Fixed Volume - MFV
  - Back Purge - MBP
  - Top Reactor - MTR
- Cylinder Samplers (Liquid or Gas State)
  - Closed Loop Cylinder – MCL or MCG
- Gas Concentration Sampler – (Gas State) - MGC

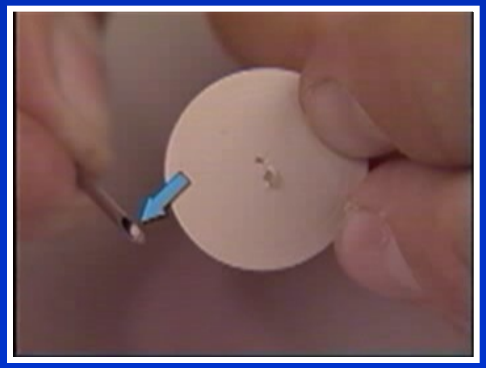
Low-E Sampler Features

- Needle Assembly
  - Patented “non-coring” needles allow for complete resealing of the septum
  - Side discharge needles help dissipate energy against the side of the bottle
  - Separate process and vent needles
  - One piece needle assembly provides easy removal without needle valve disassembly
  - Process/Vent needle diameters (OD) include .065”, .083” and .110” for various viscosities and fluid types
- Tube Stub Assembly
  - .188” for fluids with solids content

Low-E Sampler Features

- Low emission needle and septum design
- Patented non-coring needles
- Superior sealing of septum
- Eliminates needle plugging





Low-E Sampler Features

- Shroud design
  - Tapered shroud assures septum and needle alignment
  - Prevents accidental spillage or needle breakage
  - Standard and custom designs to fit customer supplied bottles
- Sample Bottle
  - 60 ml (2 oz.) to 1000 ml (32 oz.) round borosilicate high purity glass with replaceable septums
  - Septum is Teflon® backed silicone
  - Multiple other bottle and septum size and materials are available
- Viton and Teflon® seals and o-rings
  - Kalrez® available

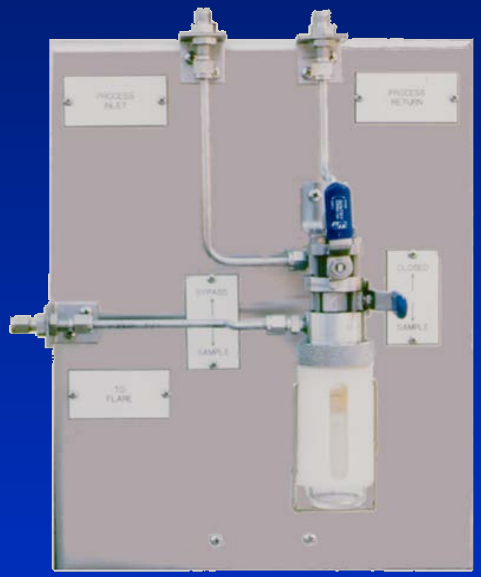
Low-E Sampler Features

- Disassembly without shutting process down
- Needle and tube stubs interchangeable between units
- Minimal dead volume
- Optional Nitrogen purge
- Adjustable orifice to reduce pressure

Low-E Sampler Features

- Custom designs and materials of construction are available
- Vent to carbon canister, waste/flare header or other recovery system
- Optional designs for enclosures
  - Heaters
  - Eductor systems for fume evacuation
  - Window kit
  - Glove boxes
- ATEX and NACE compliant

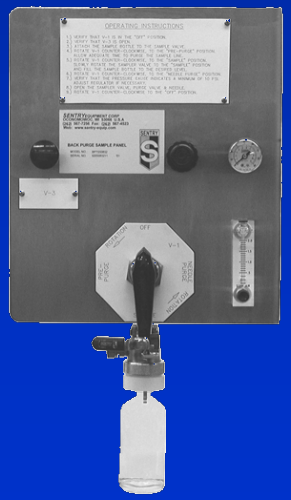
Needle/Tube Stub Samplers



MVD Sample Panel

Fixed Volume Sampler

Inline Sampler



Back-Purge Sampler

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Needle/Tube Stub Models

- Sentry Closed Loop Sampler – MVD
- Inline Sampler – MIL
- Fixed Volume Sampler – MFV
- Back Purge Tank Sampler – MBP
- Top Reactor Sampler - MTR

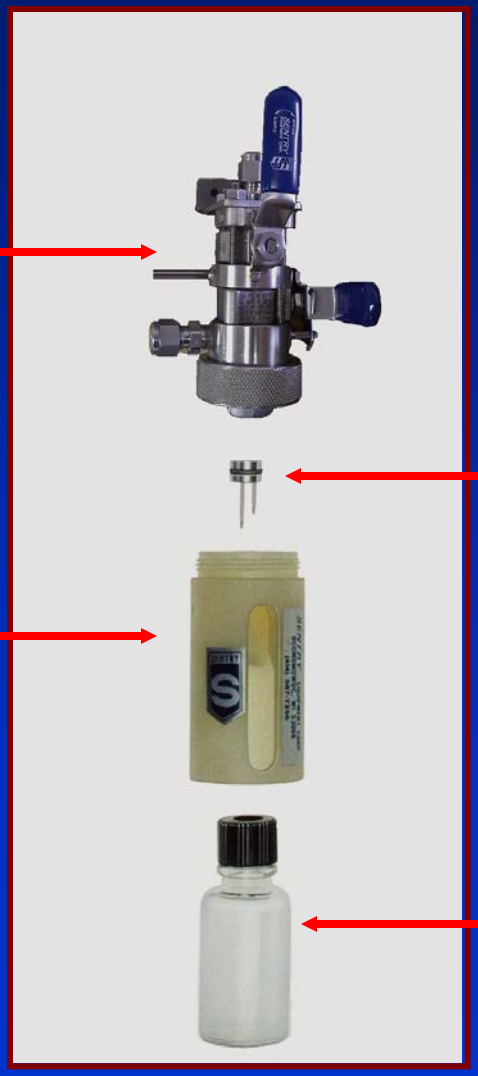
Sentry Closed Loop - MVD

Double Ball Valve Assembly

Needle Assembly

Bottle Shroud

Sample Bottle



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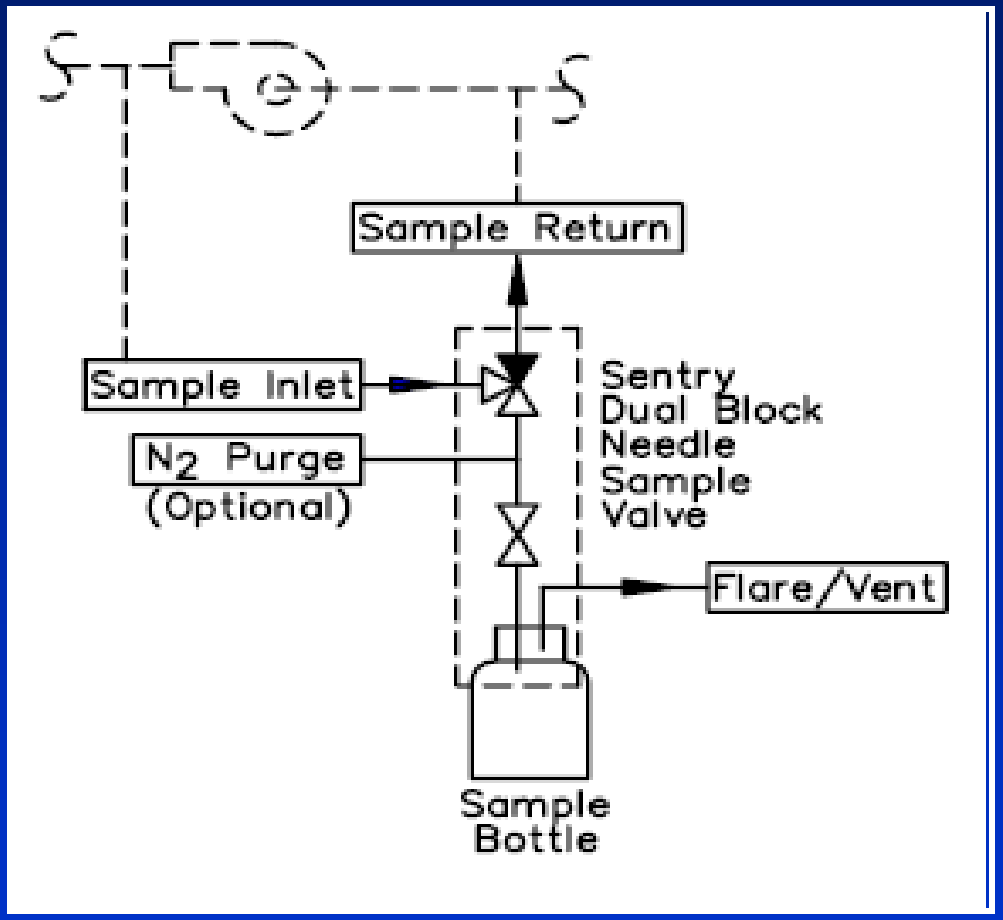
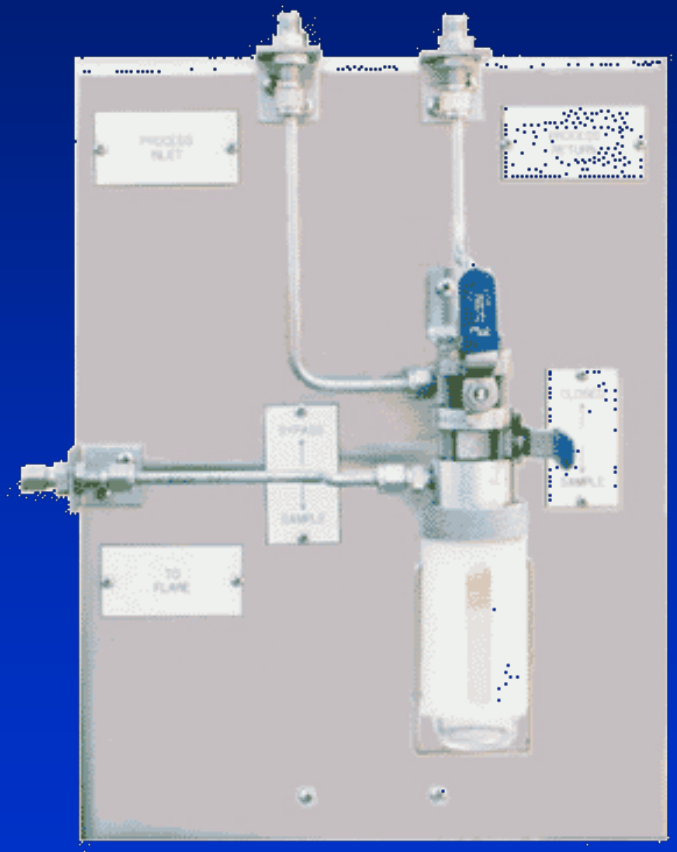
Sentry Closed Loop – MVD P&ID



Sentry Closed Loop - MVD

- Double Ball Valve Assembly
- Needle or tube stub assembly
- Bottle Shroud
- Pressures up to 1000 psi (70 bar)
- Temperatures up to 250°F (122°C)



Optional panel mount shown

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Sentry Closed Loop - MVD

- Double Block Valve
  - 3-way and 2-way ball valve provides a double block valve and leak tight assembly
  - 3-way valve speed loop provides a fresh and representative sample at all times
  - 2-way throttling valve with spring return “Dead man’s handle”

Questions?

Inline Sampler - MIL

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Inline Sampler - MIL

- Direct inline liquid sampling
- Flanged or NPT end connections
  - Other connections are available as options
- Pressures up to:
  - 2,200 psi (150 bar) at 100°F (38°C)
  - 100 psi (7 bar) at 450°F (232°C)
- Connection styles
  - ½" NPT
  - Flanges ½" – 1.5"
    - Flanged end connections have lower pressure ratings. Consult factory for rating.
  - Compression 0.25" – 1.00"
- Spool piece with flanges and pitot tube included for line sizes over 1.5"

Tandem Switching Valve

- (2) 3-way ball valves with single action gear drive
- Used on fixed volume, closed loop cylinder, and MGC samplers
- Eliminates the need for manipulation of multiple individual valves
- Improves safety, simplifies operation

Fixed Volume Sampler - MFV

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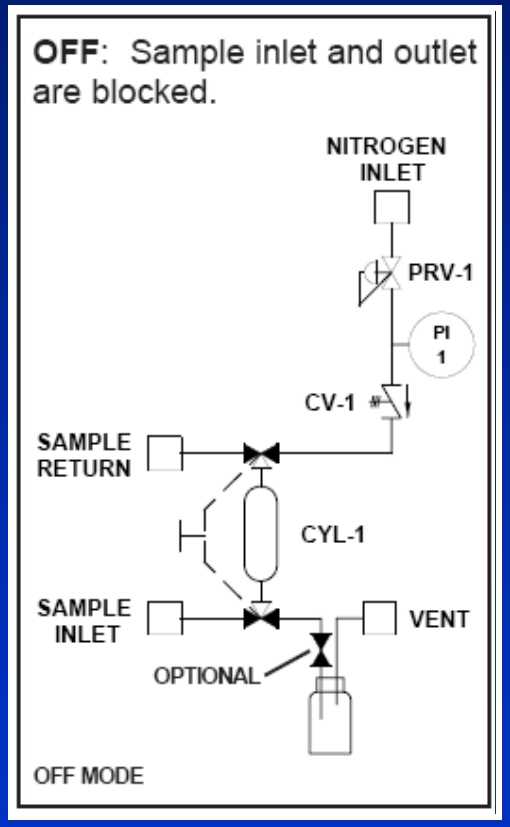
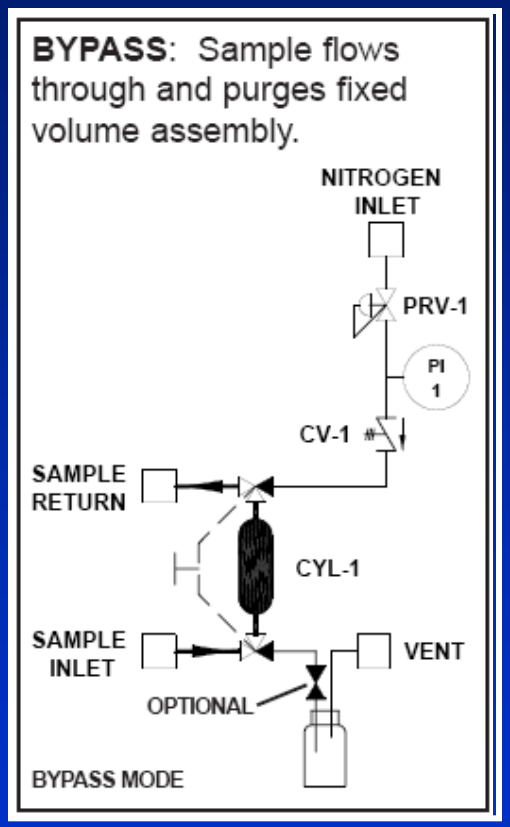
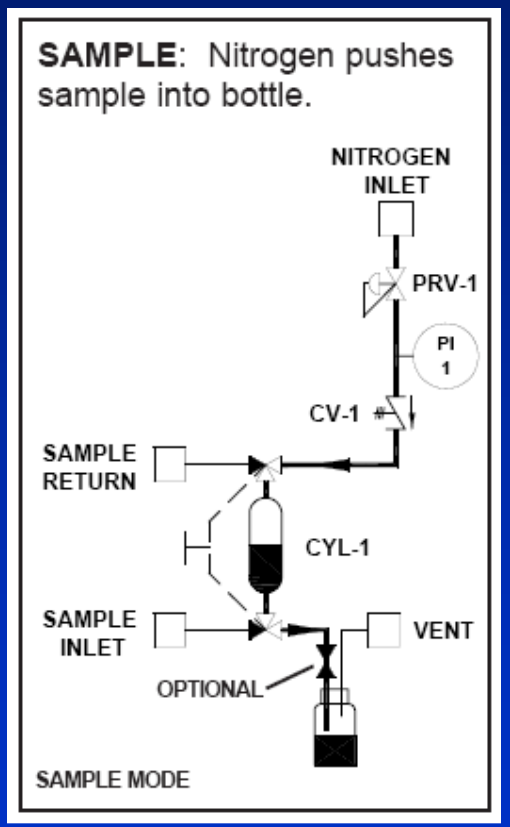
Fixed Volume Sampler - MFV







Fixed Volume Sampler - MFV

- Single action tandem switching valve for safety and simplicity
- Collects a representative and repeatable fixed volume of sample
- Eliminates possibility of over filling the sample bottle system purge
  - provides zero dead volume
  - Prevents cross contamination between samples
- Easily change volume size without changing tubing

Fixed Volume Sampler - MFV Sequence of Operation

Questions?

CLOSED LOOP CYLINDER SAMPLER MCL & MCG

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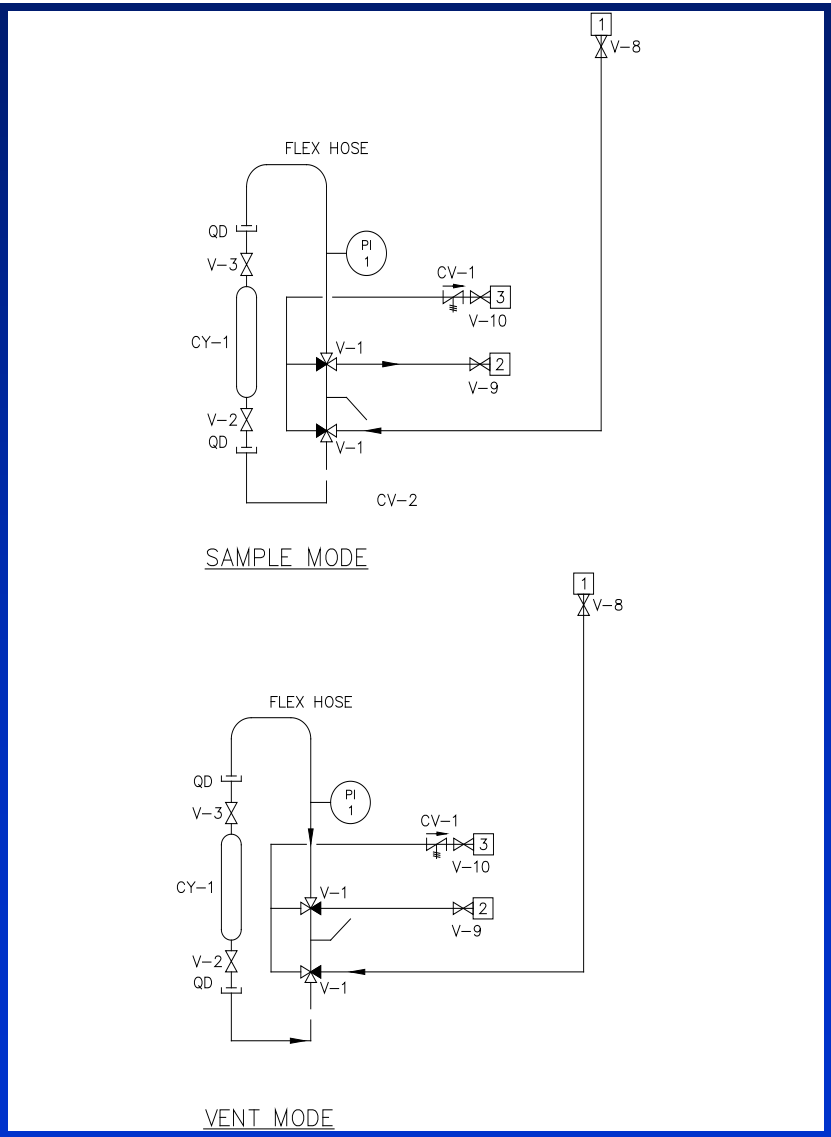
Closed Loop Cylinder Sampler



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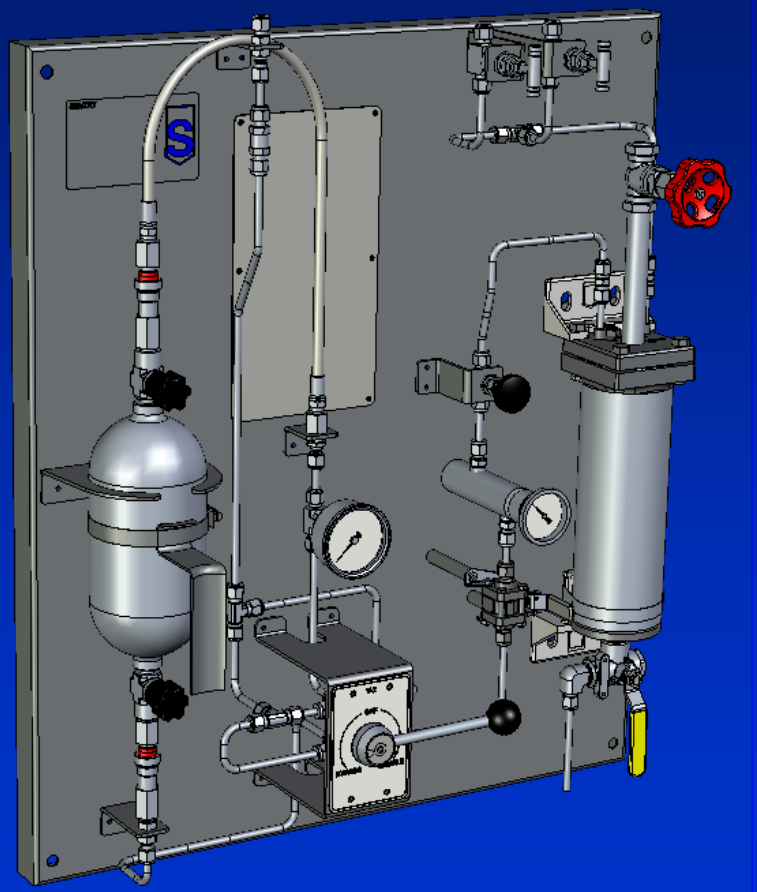
Closed Loop Cylinder Sampler

- Used for gas, gas/liquid, and LPG applications
  - High vapor pressure fluids
- Speed loop assures fresh and representative sample every time
- Quick connects allow for easy removal and transportation of the sample cylinder
- Self-sealing fittings prevent leakage when cylinder is removed

Closed Loop Cylinder Sampler

- MCL Panel with sample cooler system and N_2 Purge.



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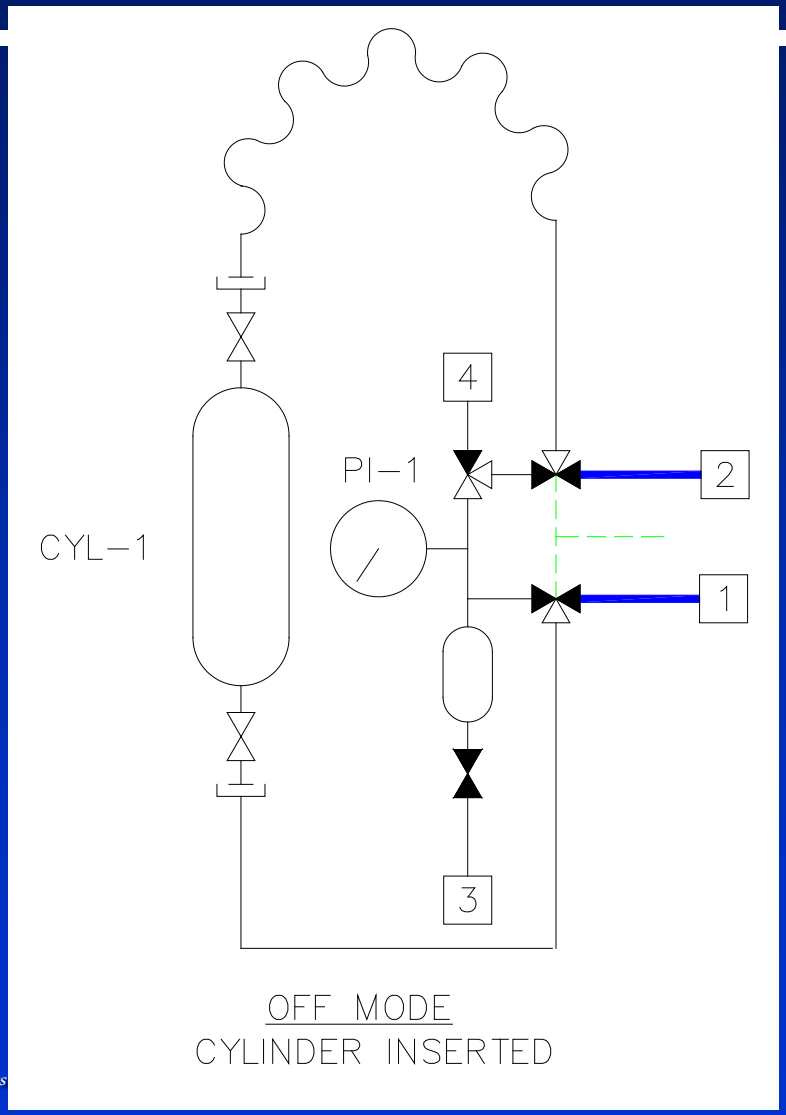
Questions?

MCL Sampler for LPG and Liquids



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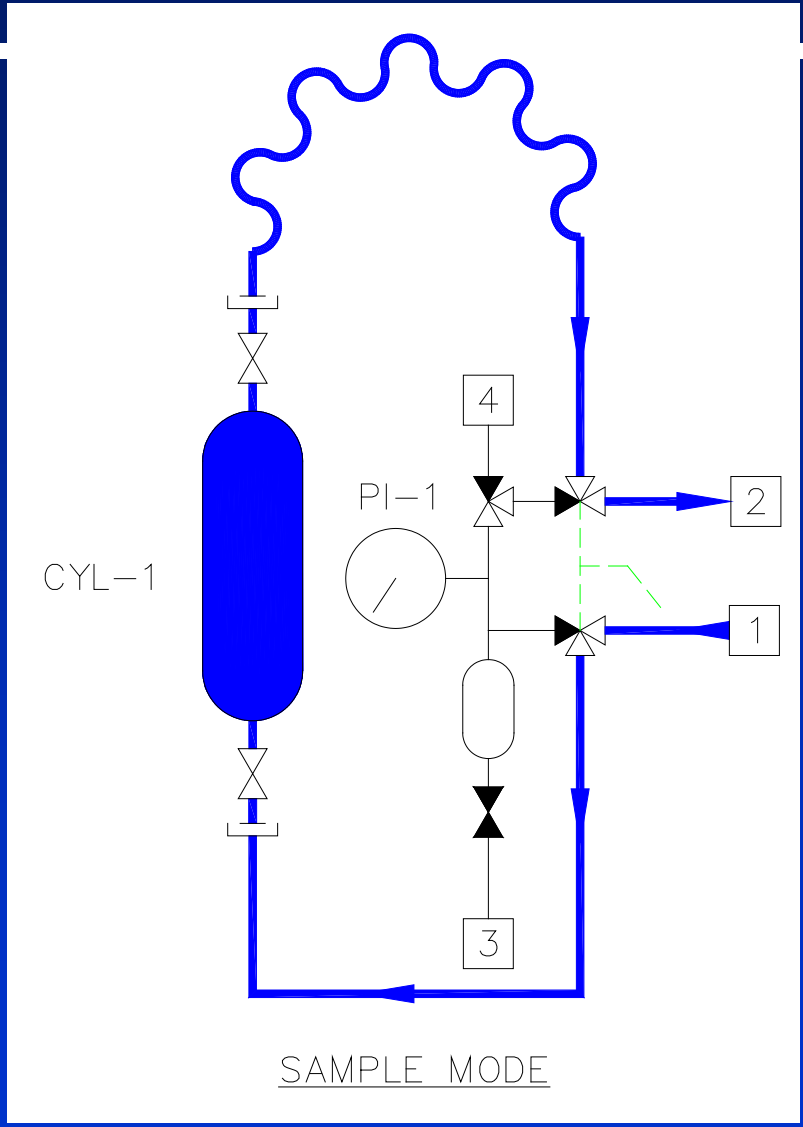
MCL Sampler for LPG and Liquids



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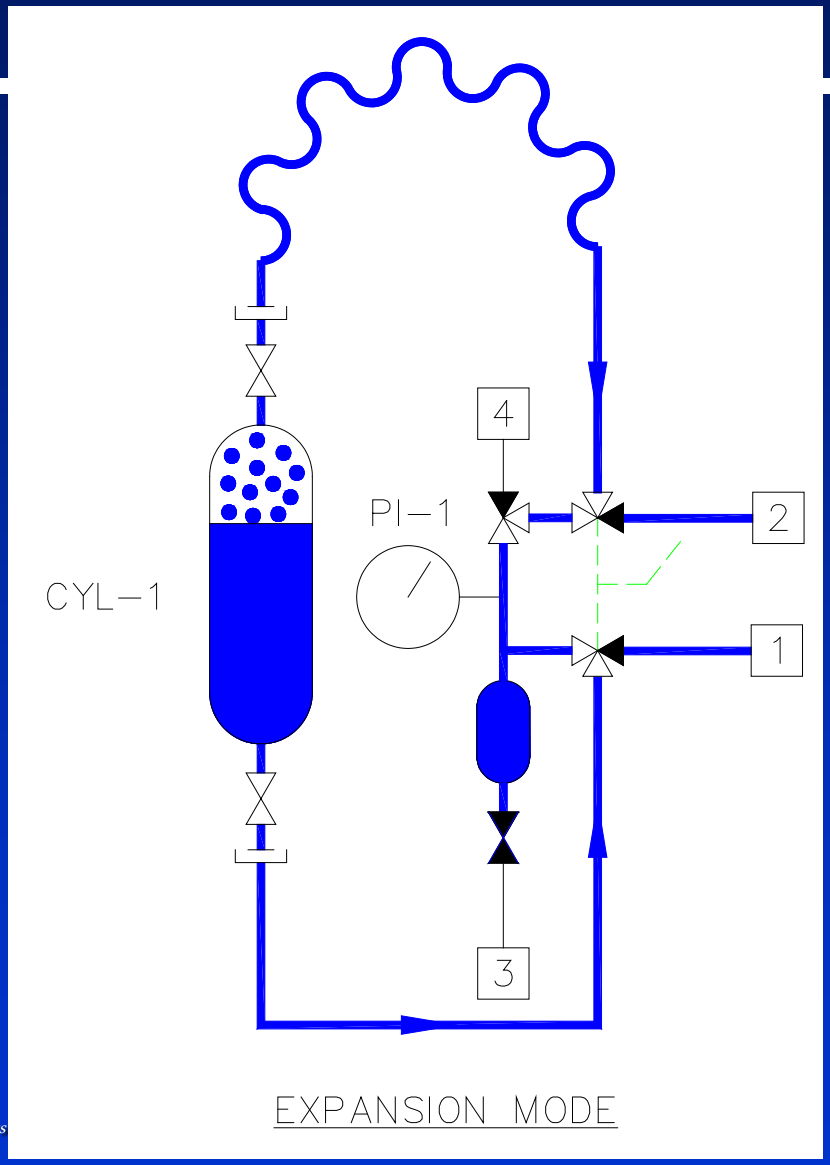
MCL Sampler for LPG and Liquids



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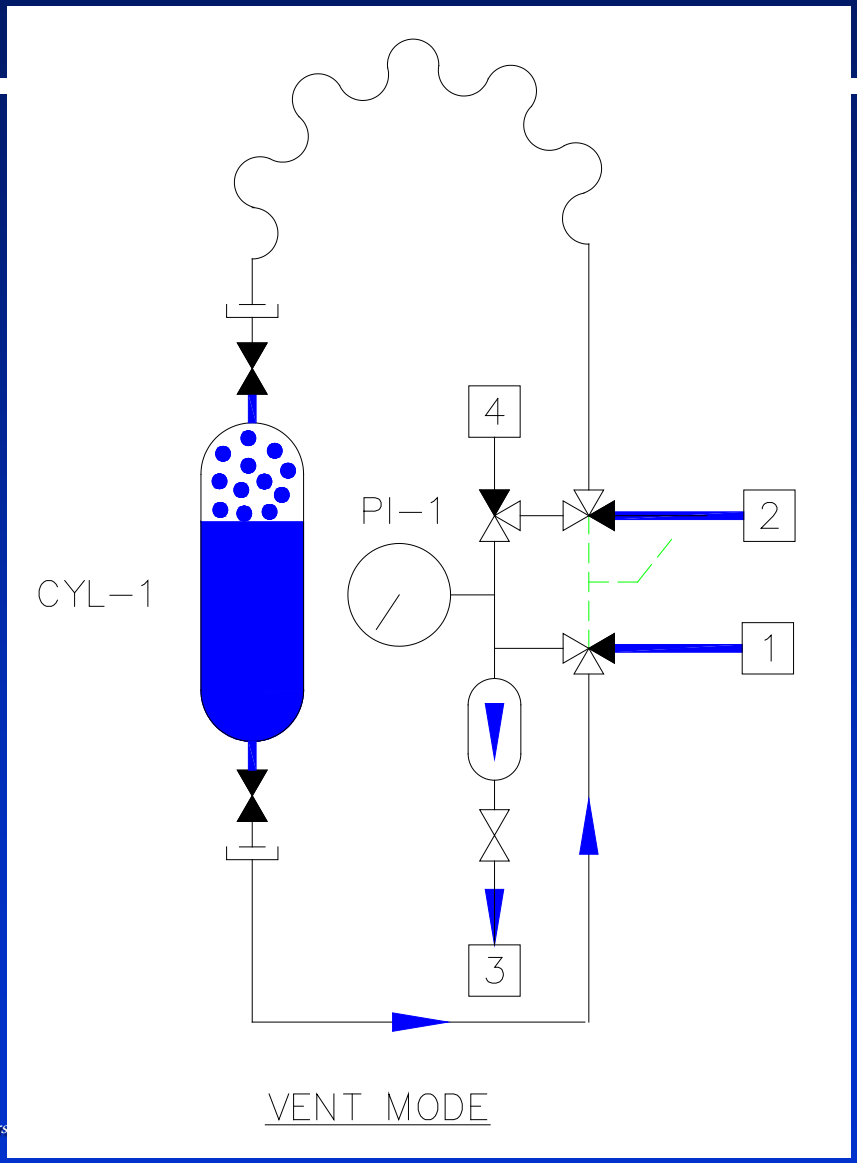
MCL Sampler for LPG and Liquids



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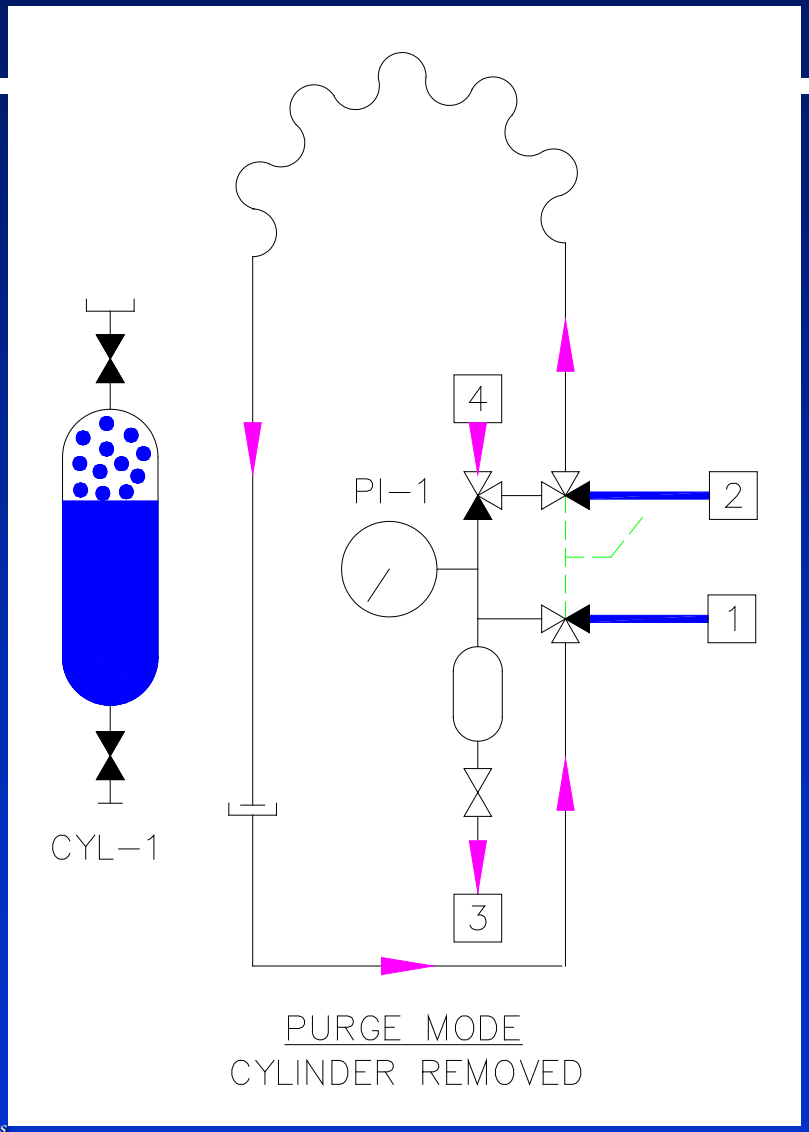
MCL Sampler for LPG and Liquids



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GasGrab®
Gas Concentration Sampler

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What is H_2S?

- Hydrogen Sulfide
- Colorless Gas
- Smells like Rotten Eggs
- Poisonous
  - First you smell it, then you don't, then you die!

Where does H_2S come from?

- Found in natural gas and petroleum
- Exists in solution in crude oil
- Released at all stages of the refining process
- Accelerated by heat
- Hydro sulfuric Acid, Sewer Gas

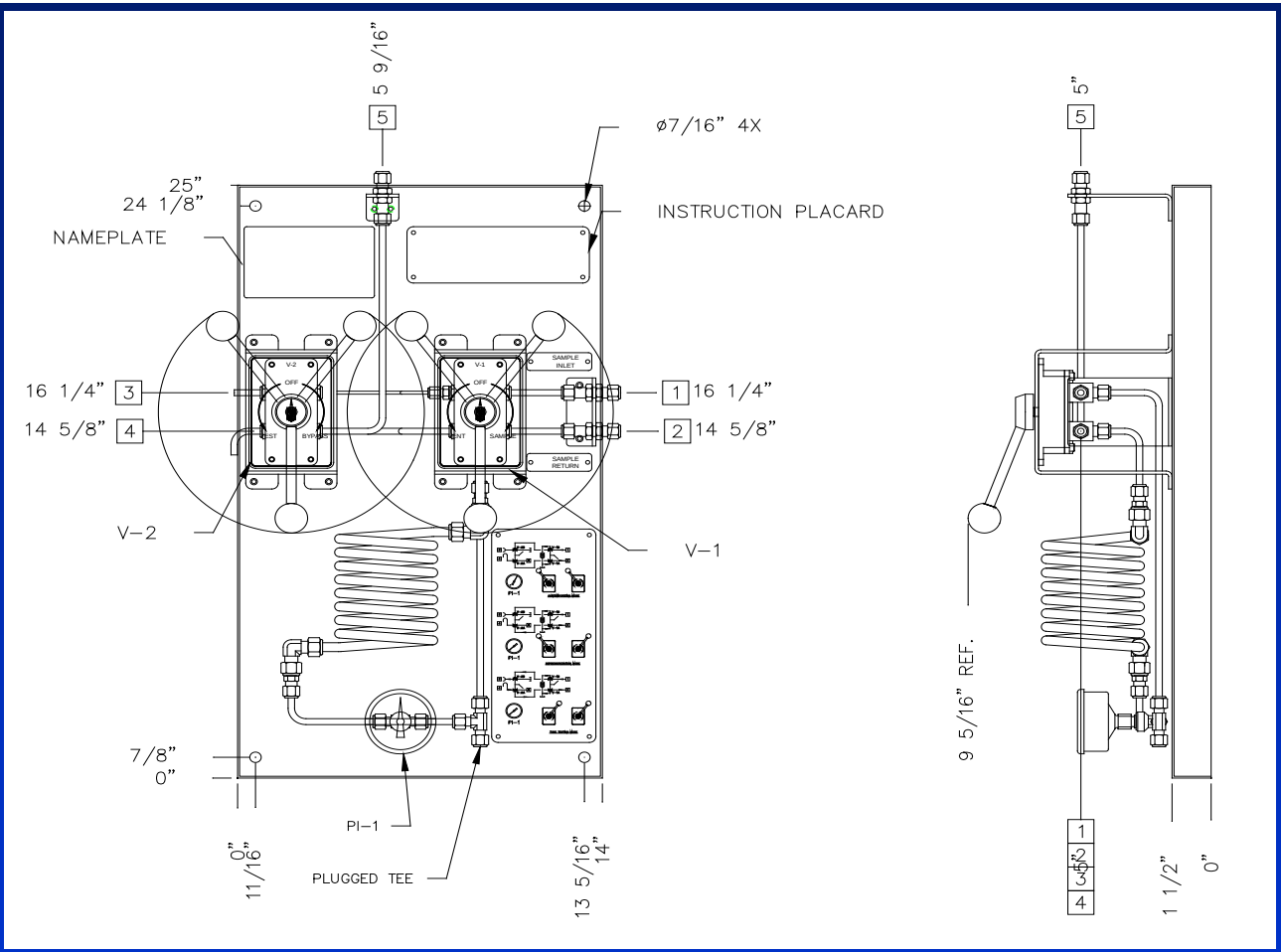
MGC Sampler

- The Sentry MGC Sampler takes a safe, constant and repeatable sample every time without exposing the operator to the gas
- Not only extracts a sample but offers a means to analyze it in real time without the use of electronics
- The Sampler uses Dräger or Rae Tubes to measure gas concentration
  - These types of tubes are used to test the amount of H_2S in a sample

Dräger and Rae Tubes

- No calibration - ready for immediate use
- Low cost, economical ($6 - $10 each)
- Reproducible and accurate
- On the spot, quick, direct measurement

General Arrangement Drawing



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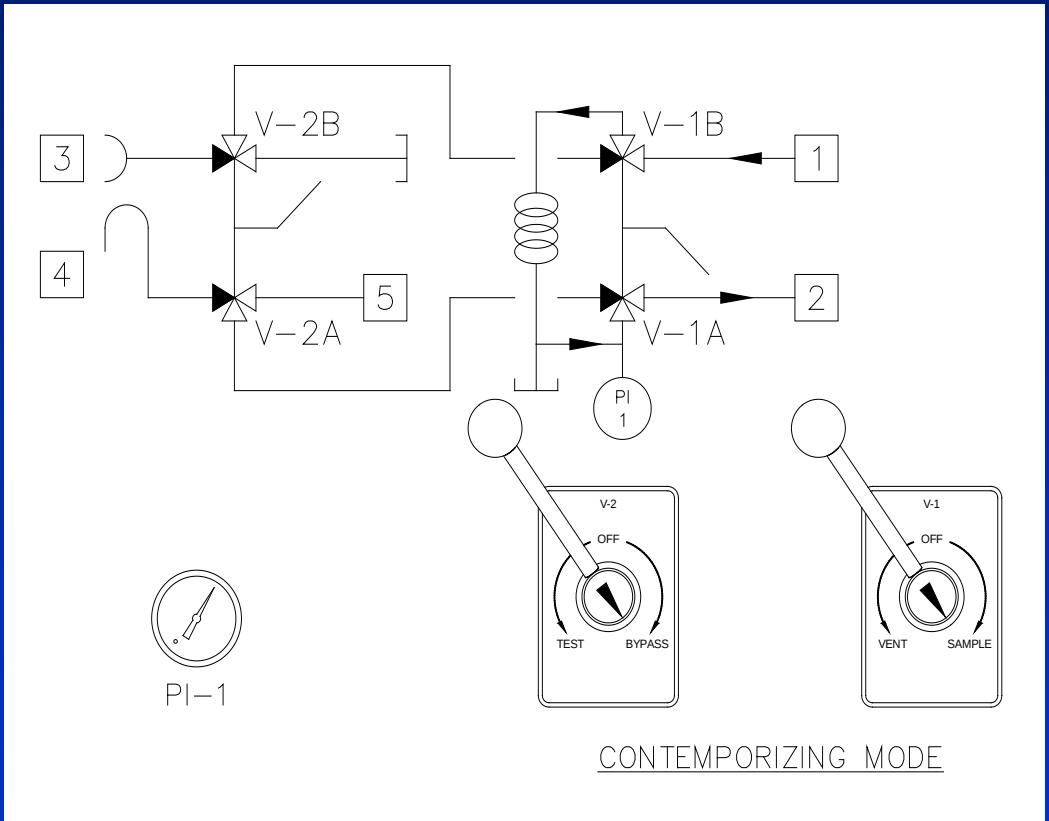
P&ID



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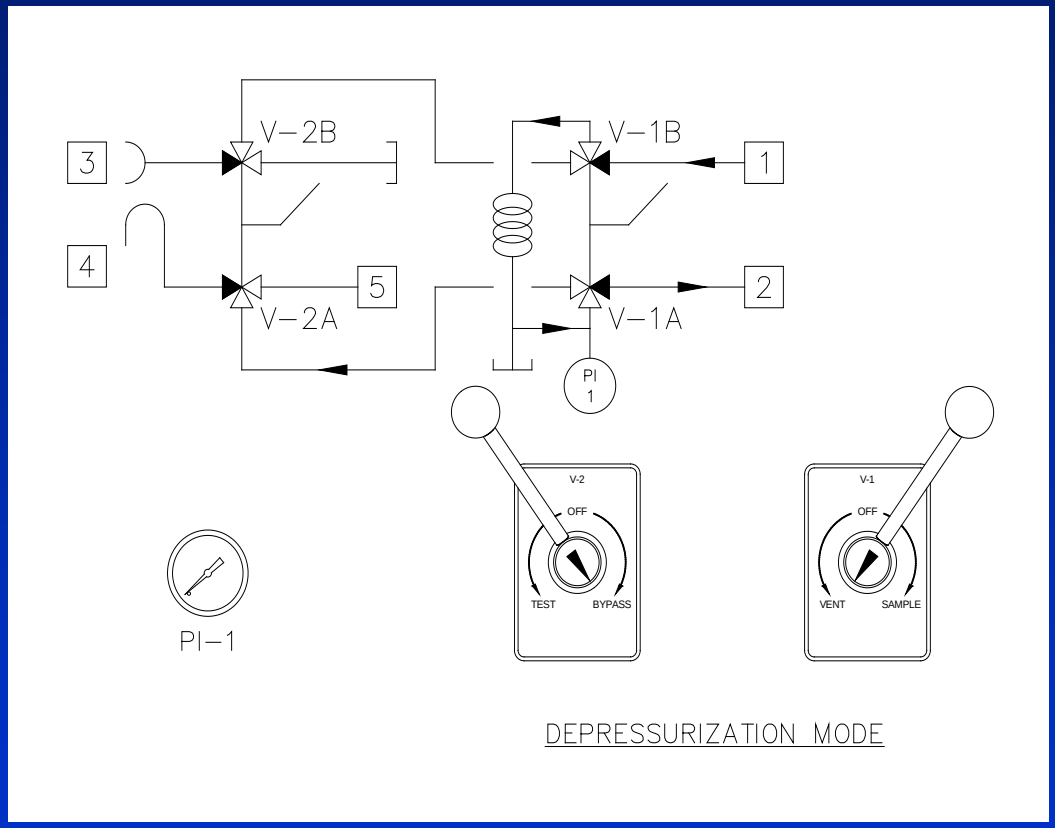
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V–2A
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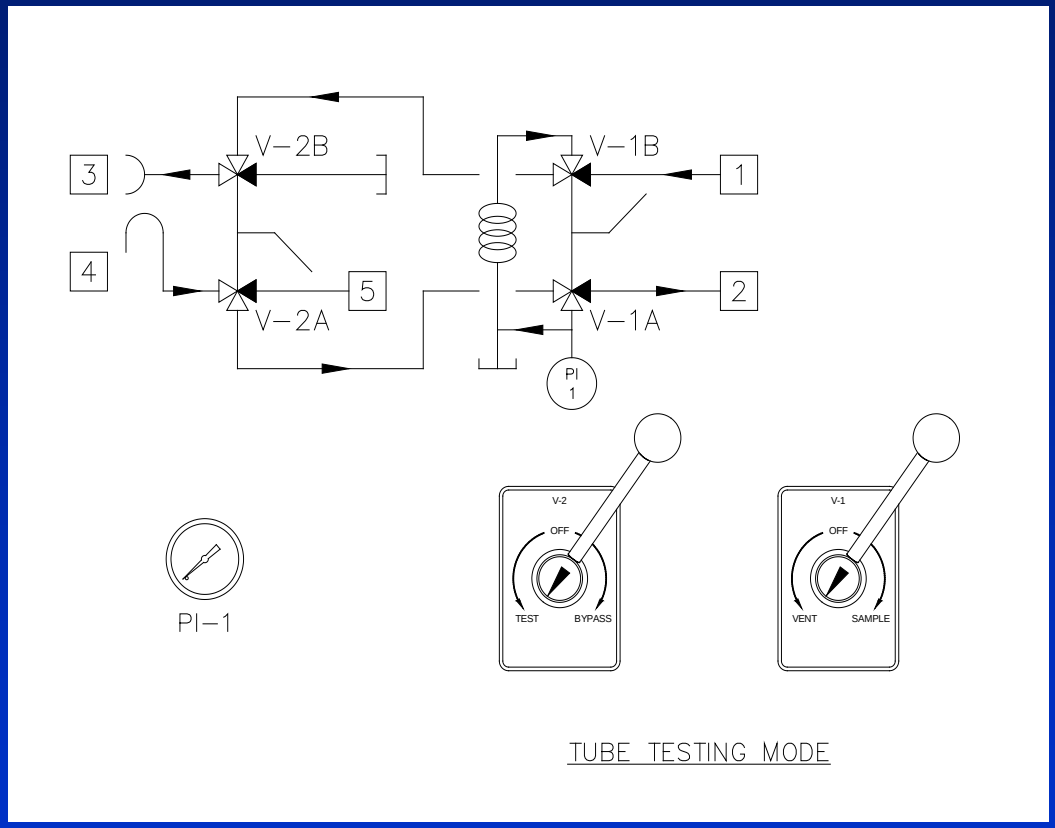
SAMPLE
DEPRESSURIZATION MODE

P&ID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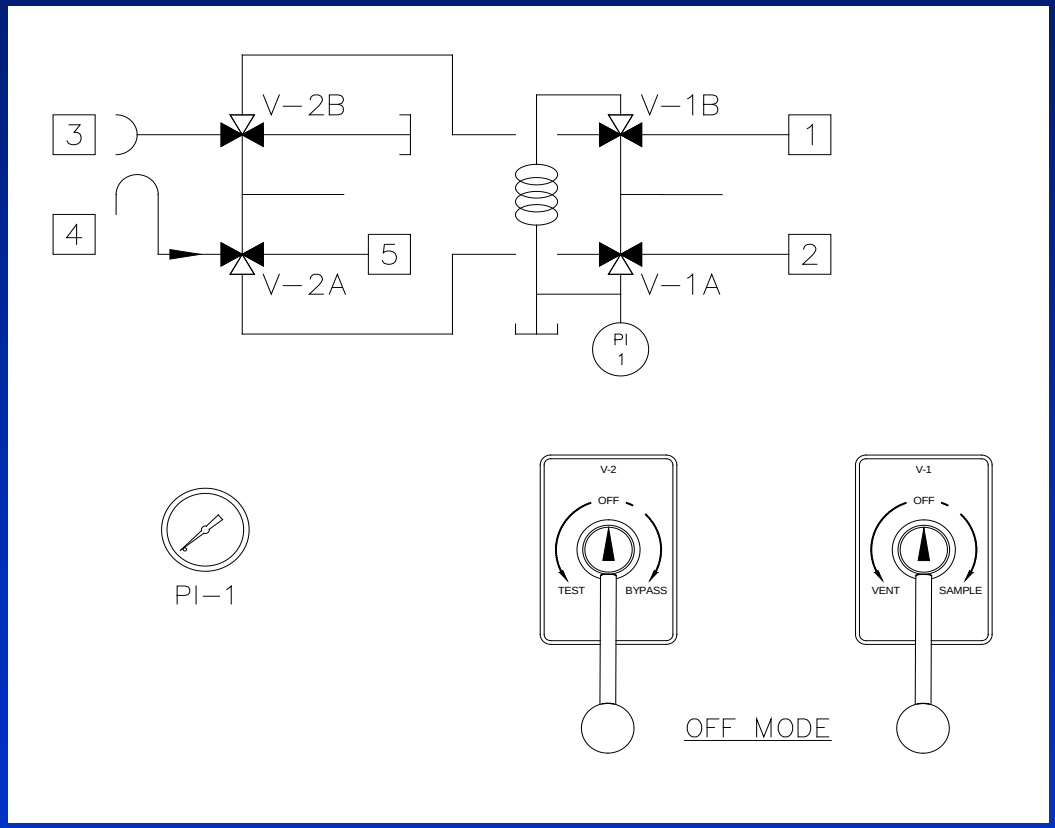
SAMPLE
TUBE TESTING MODE

P&ID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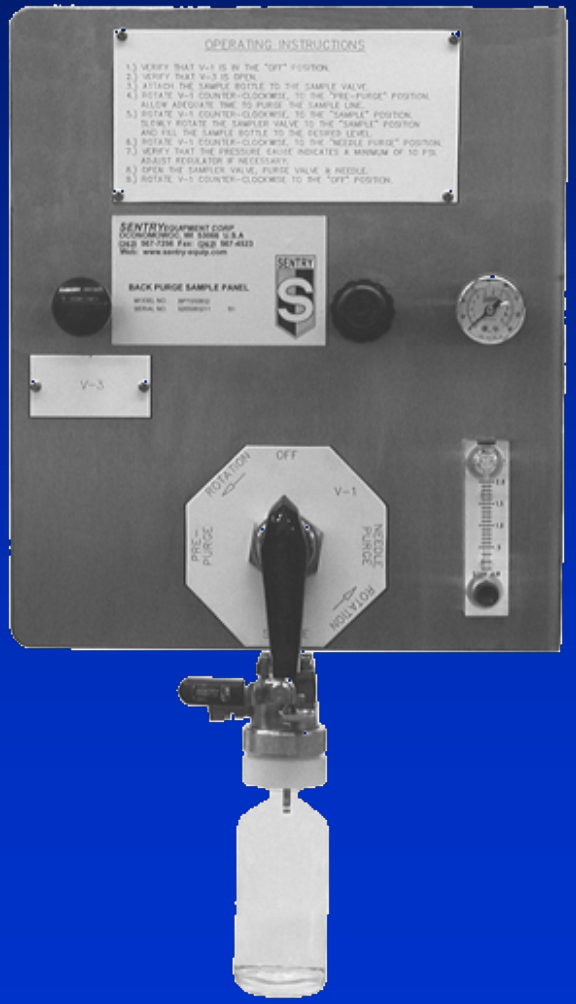
SAMPLE
OFF MODE

Questions?

Back Purge Tank Sampler - MBP



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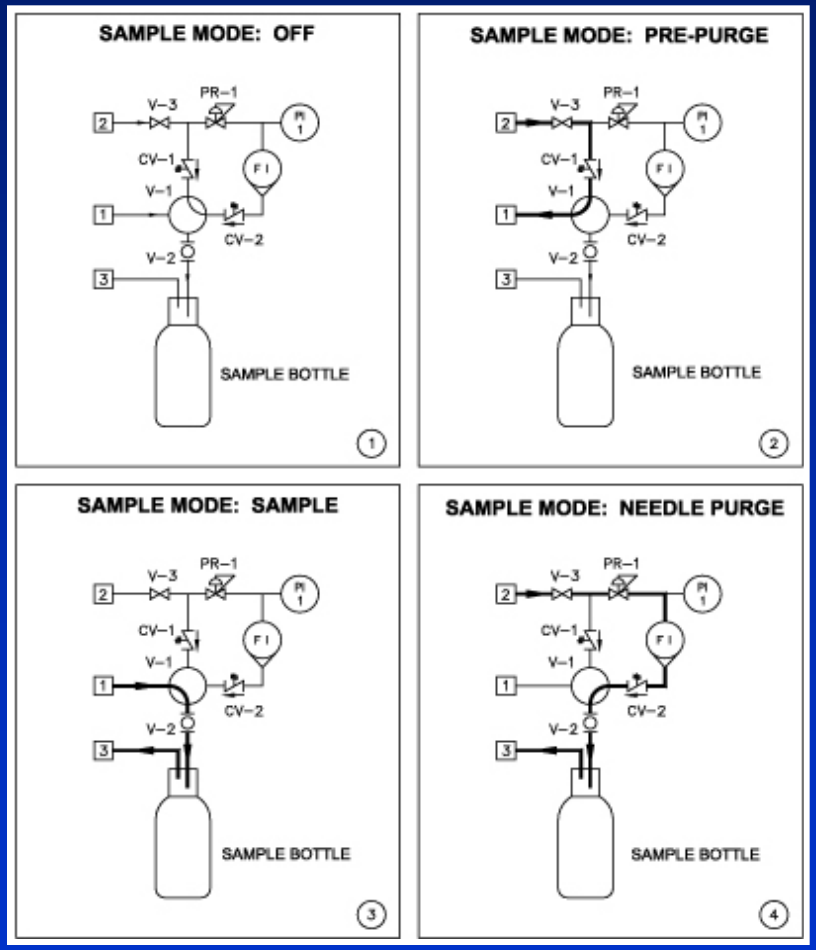
Back Purge Tank Sampler – MBP P&ID



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Back Purge Tank Sampler – MBP Features

- Sample from tanks, vessels, or pipes without a speed loop or bypass
- Eliminates sample waste by purging the sample line and sample panel back to process prior to taking a new sample
  - needle purge completed after sample is collected

Questions?

Top Reactor Sampler - MTR

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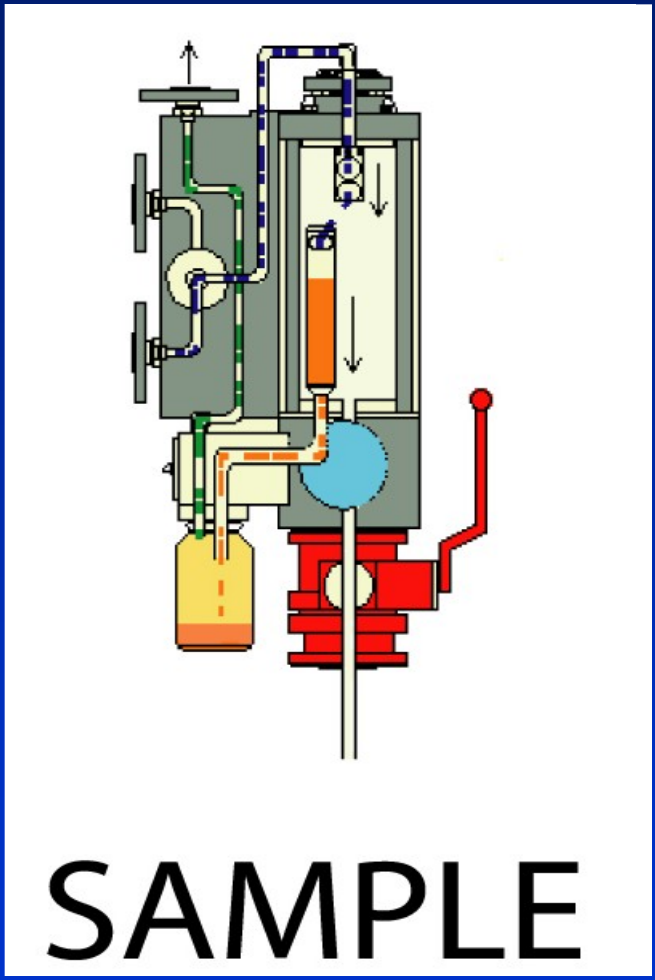
Top Reactor Sampling



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Top Reactor Sampler - MTR Features

- Unique standpipe design eliminates sample flushing
- Corrosion resistant wetted materials
- Designed with oversized valve ports to prevent plugging

Top Reactor Sampler - MTR

- Designed to take a representative sample from the top of a reactor vessel
- Unique standpipe overflow design eliminates contaminating the vacuum source used to draw the sample
- Transparent glass sampling chamber allows operator a clear view during sample operation
- Sampling valve and ball isolation valve provides for double block isolation from the reactor

Top Reactor Sampler - MTR

- Allows sampling under vacuum or from pressure
- Unique standpipe design eliminates sample flushing
- Corrosion resistant wetted materials
  - The MTR is mounted on top of a multi-ported PTFE/Hastelloy® sampling valve assembly and a PTFE lined ball valve
- Designed with oversized valve ports to prevent plugging

Top Reactor Sampler - MTR

Features

- Last sample pulled into the chamber is saved for analysis
- Glass sample chamber
- Double ball check on the chamber outlet
- Prevents overflow and contamination of vacuum lines

Benefits

- Guarantees a fresh sample from the vessel, not what was trapped in the tip tube
- Allows visual inspection during the sample filling process

Top Reactor Sampler - MTR

Features

- Materials of construction are PTFE, borosilicate glass, and Hastelloy
- Sampling and isolation valve
- Liquids and powders may be Introduced through the MTR

Benefits

- Easy cleaning and reduces corrosion
- Double block isolation from reactor vessel for maximum safety
- Allows both solvent flush or catalyst introduction

Questions?

Markets Served

- Refineries
- Petrochemical Plants
- Pharmaceuticals
- Chemical Plants
- Nuclear Power Plants

Questions?