Considerations in Process Sample Systems

Part 5: Best Practices for Installation of Gaseous Sample Pumps

Goal of the Gas Sample Pump

Transport a clean, reliable, sample of the process gas to the analyzer, in the safest and easiest way possible, to ensure accuracy and reliability.

Required information to ensure proper pump selection

For most gas sampling applications, the following information is required to determine the pressure drop and proper pump selection:

- Sample point conditions atmospheric, vacuum, or positive pressure
- Analyzer pressure requirements
- Endpoint considerations (Vent to Atmosphere or return back to process)
- Required Flow Rate or Response Time
- Temperature and Type of Gas being pumped
- Ambient temperature where pump will operate
- Distance and diameter of tubing
- Voltage, frequency, and electrical classification (Safe area, Division I, Division II)

Pump Location and Line Sizing is Key

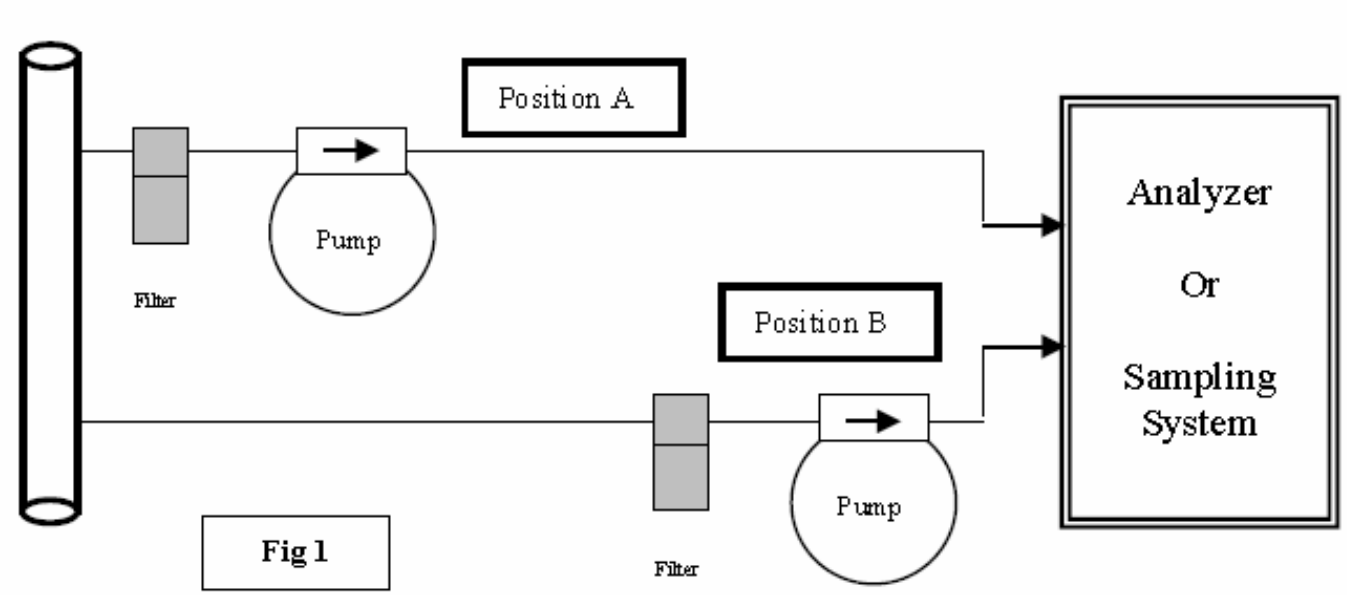


Fig 1

SIZE	I.D.	Line Press Drop - Pos A	Line Press Drop - Pos B
1/4 x .035” wall	.180 inch	20.0 PSIA - 14.7 PSIA = 5.3 PSID	14.7 PSIA – 7.3 PSIA = 7.4 PSID
3/8 x .035” wall	.305 inch	15.0 PSIA – 14.7 PSIA = .3 PSID	14.7 PSIA – 14.3 PSIA = .4 PSID

Pump Location and Line Sizing is Key

- Comparing tubing pressure drops for pressurized and vacuum sample line conditions illustrates the importance of line size; in addition, a larger displacement pump may be required for smaller line sizes because of vacuum conditions and decreased density.
- Final selection of line size and pump location is effected by many factors, including local codes, environmental considerations, system design, and installation requirements.
- Vapor condensation may be a problem if pump is located a long distance from process inlet and sample pressure is reduced below gas vapor pressure.

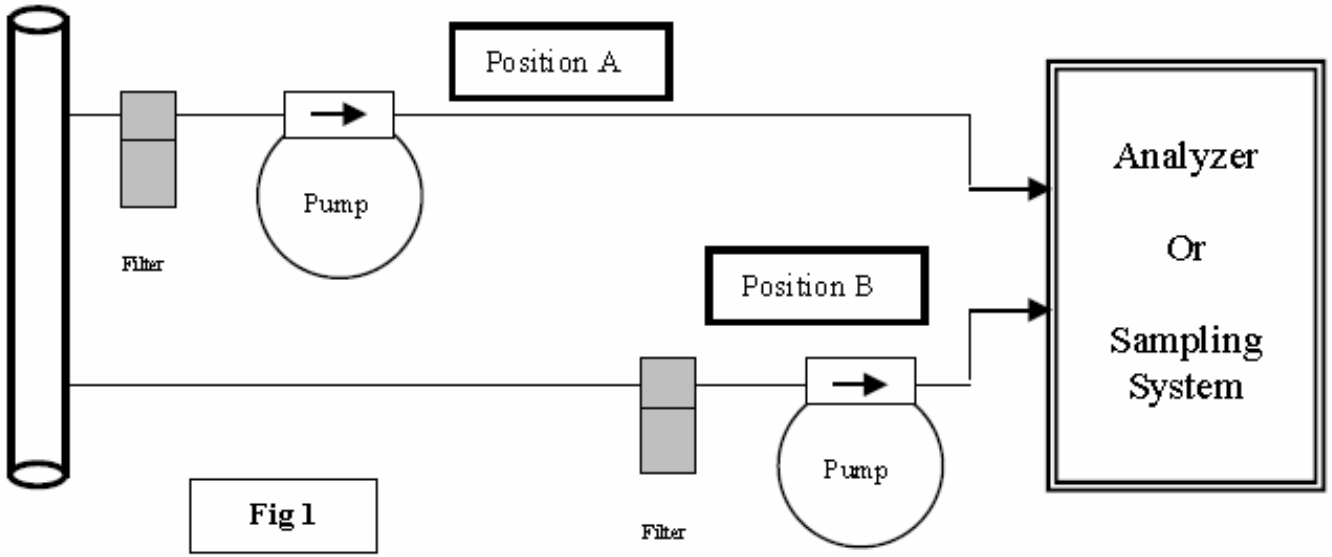
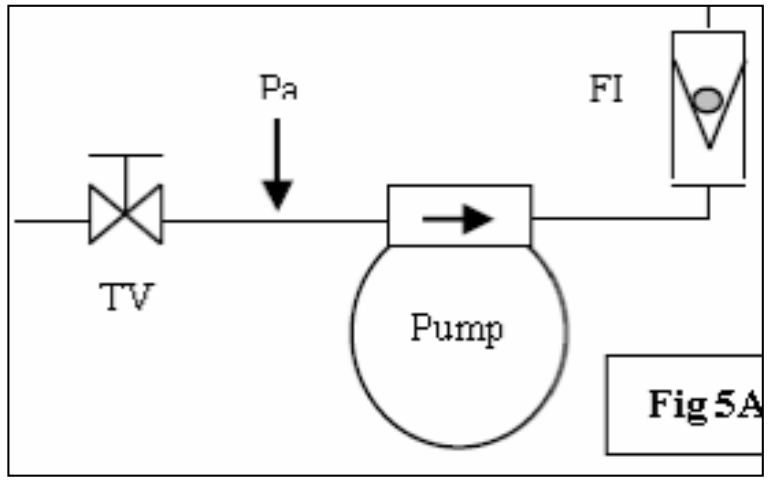
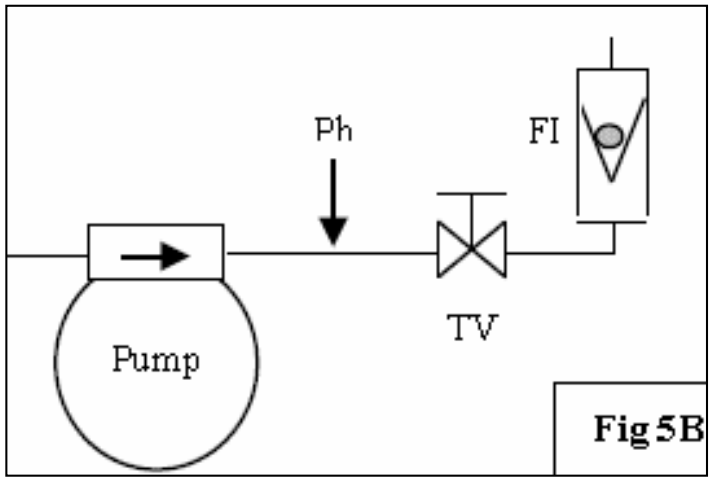


Fig 1

Flow and Pressure Control





Configuration A

Flow rate reduced by increased restriction by Throttle Valve TV, resulting in pressure reduction at **pump inlet**. With TV closed, Pa will decrease to less that –14 PSIG.

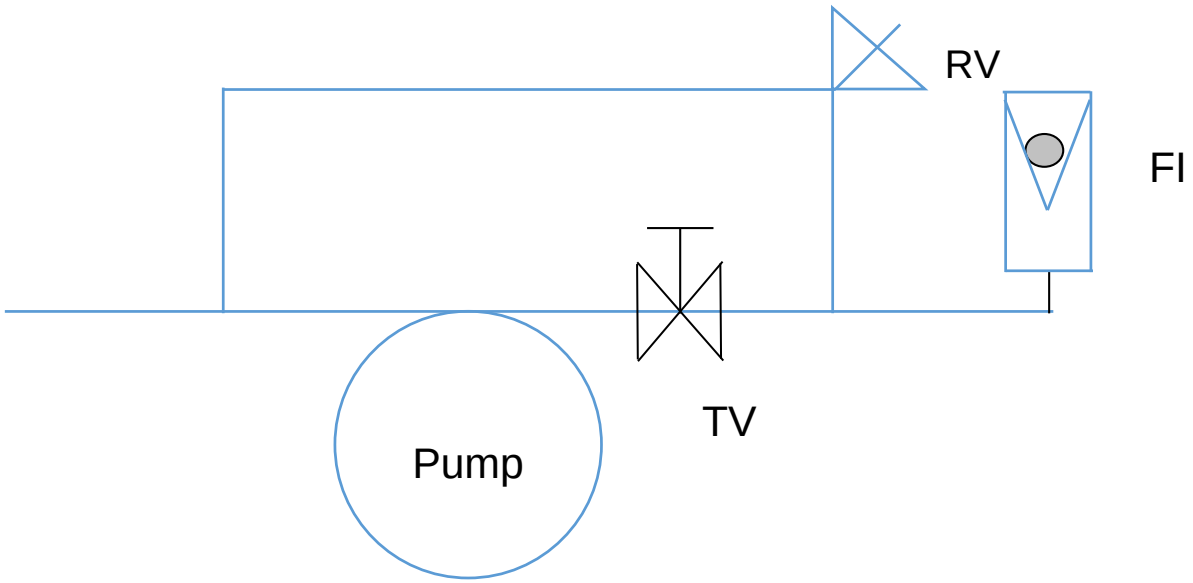
Configuration B

Flow rate reduced by increased restriction by TV, increasing pressure at **pump outlet** – up to maximum of pump capacity. Depending on pump characteristics, pressure increase at Pb may range from 30 PSIG to 100 PSIG or more.

Summary

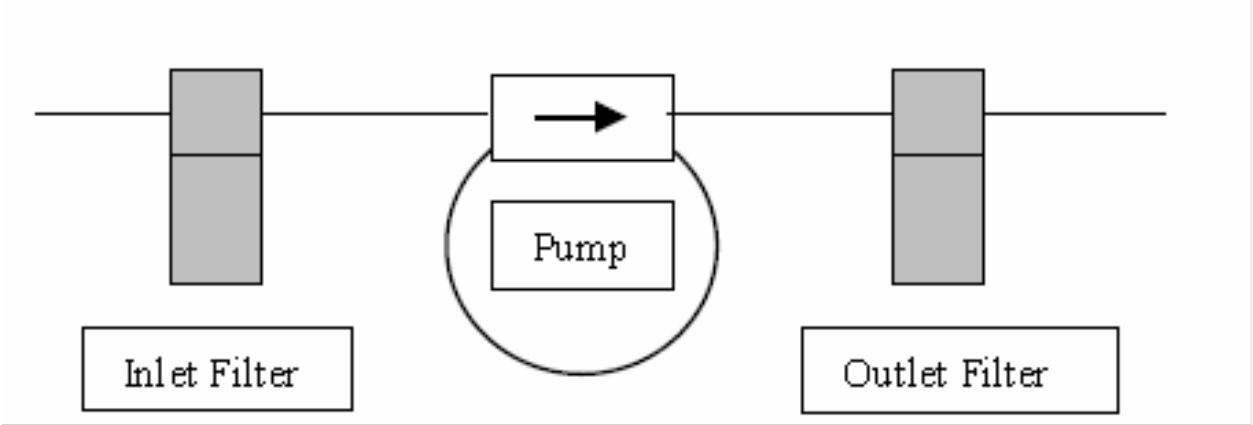
Excessive pressure on pump diaphragm (Configuration B) will result in increased diaphragm and bearing stress, reducing pump life and increasing service requirement.

Flow and Pressure Control



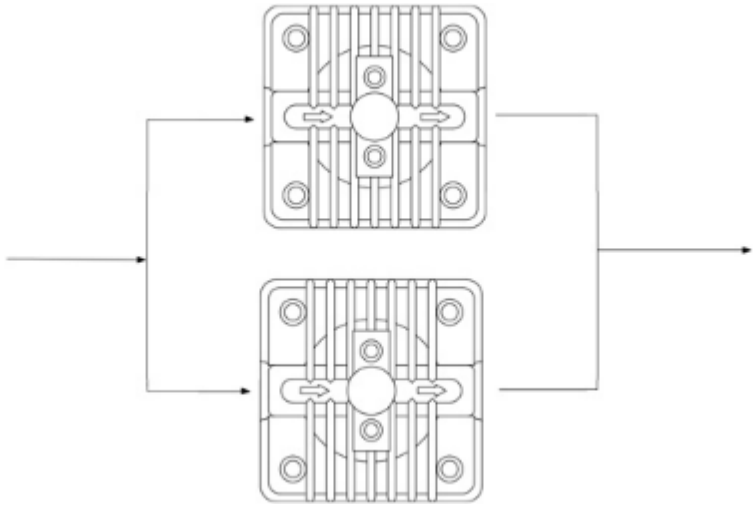
Relief valve reduces high pressure pulses on pump diaphragm, flow pulses will be reduced; return line may be connected to process or pump inlet. (Lowest Cost)

Flow Pulsations



Addition of a filter at the inlet & outlet will reduce the **pump outlet** pressure pulse amplitude. This is important when flowmeters or other pressure-sensitive instrumentation is used, as pulsation will give false readings.

Double Head Pump in Parallel



When the inlet and outlet ports of the two heads are connected in parallel, there will be continuous action at the interconnect junctions and no dead time between inlet or outlet pulses. The result of this design is smoother gas flow with greatly reduced pulsation effects at the inlet and outlet connections; in addition, sample line pressure losses are correspondingly reduced because of the reduced peaked and nearly-constant flow rate.

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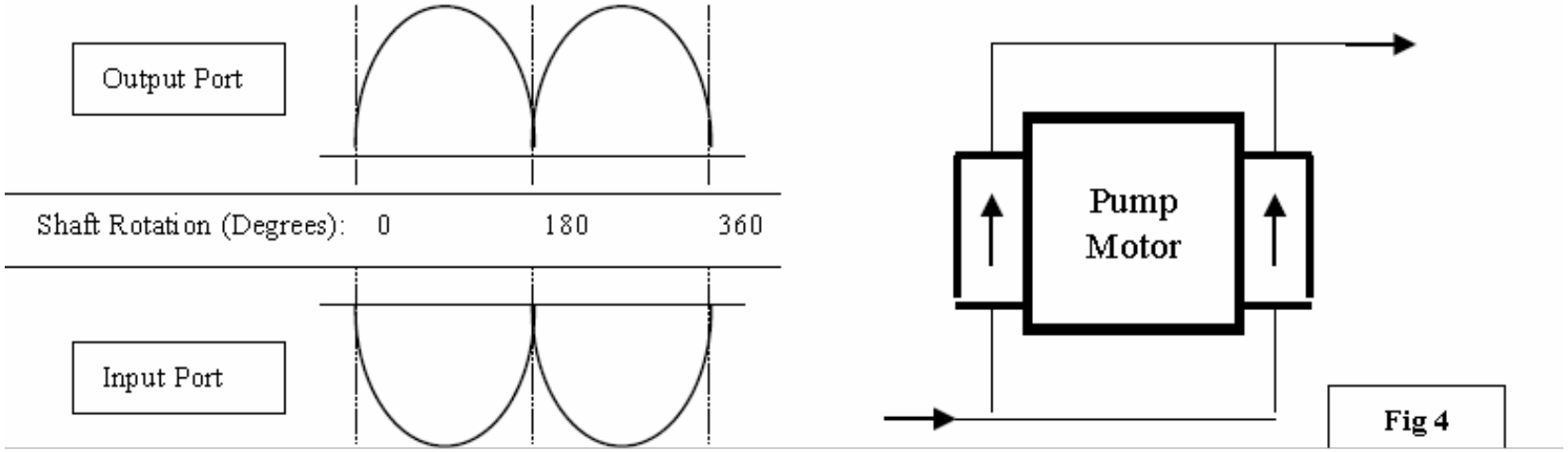

Fig 4

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Liquid Considerations

- For applications where there is potential for liquid to enter the pump head; it is advised to mount the pump in such a way so that the discharge port faces toward the ground.
- Mount pump as high in the sample system as possible.
- Heat the pump head and line to prevent condensation.
- Gas Cooler, Membrane Filters to remove liquids
- Vapor condensation may be a problem if pump is located a long distance from process inlet and sample pressure is reduced below gas vapor pressure.

ADI Pump Options

- Class I Division I Group B/C/D Explosion proof (UL & CSA)
- Class I Division II Group A/B/C/D Hazardous Area (UL)
- IP ratings – 44, 54, 65, & Marine Duty.
- 115v/230v 1 phase, 3 phase 230/460v, Air Driven
- Heated head for safe areas
- Elevated & Steam traced heads for hazardous areas
- Corrosion resistant 316ss, Hastelloy C, Teflon-coating, Silconert 2000
- All pumps ship out in 1-2 days

Thank you for your time.

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“We pass…your gas!”
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