



INTRODUCTION

- **Sample conditioning is the single most important installation consideration.**
- **80% of analyzer maintenance problems relate to sample handling.**
- **This presentation is a short overview of sample handling.**
- **It is accompanied by a copy of the full article and a lag time calculation sheet.**

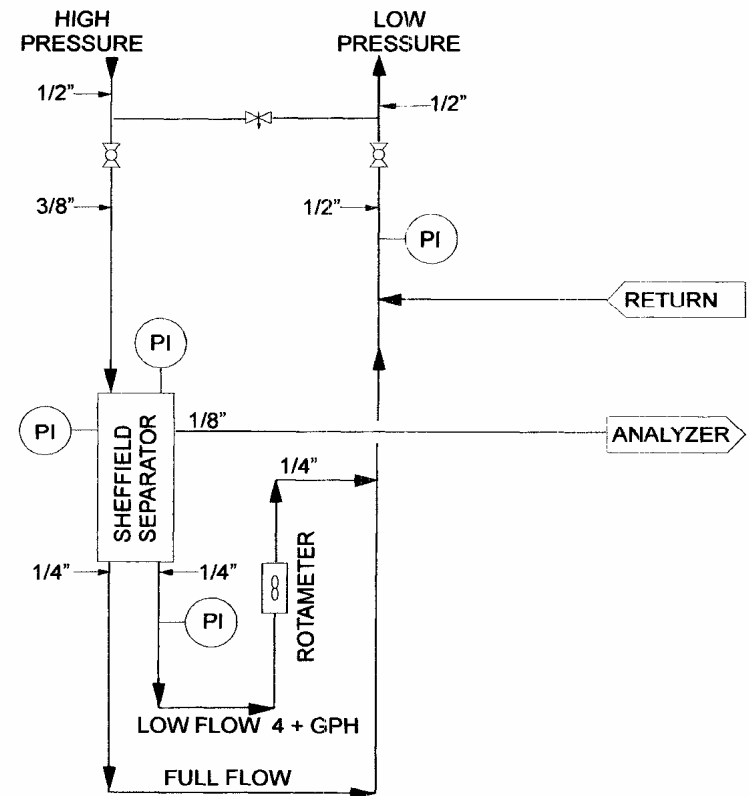


Overview

- ◆ **This presentation will cover:**
- ◆ **Sample transport, lag time, and sample conditioning.**
- ◆ **Filters and their functions.**
- ◆ **Different types of separators with their advantages and disadvantages.**

Sample Transport Systems

- ◆ The fast loop flows from the high pressure tap, to the sample conditioning panel, and then to the low pressure return point.
- ◆ Only the slipstream needs conditioning.

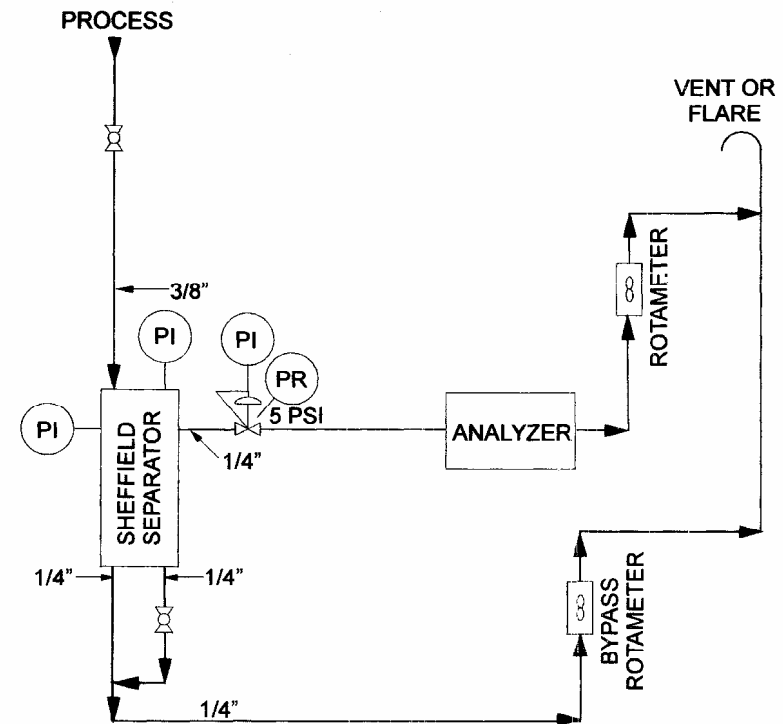


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SHEFFIELD LIQUID STRIPPER
FLOW DIAGRAM

Sample Transport Systems Cont.

- ◆ The single line transport system returns the sample to a vent, flare header, or sample recovery system.
- ◆ It is generally not recommended if lag time exceeds 60 seconds or the distance is greater than 100' from the sample tap.



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**SHEFFIELD GAS SEPARATOR
SINGLE LINE APPLICATION
FLOW DIAGRAM**



Lag Time

- ◆ Distant /velocity lag is = to the total volume of the sample handling system ÷ flow rate.
- ◆ First order lag is the delay in the conditioning devices caused by the delay necessary to mix the sample until it is representative of the current process.
- ◆ A work sheet is available for the analyzer technicians as a field reference.



Lag Time: Rule of Thumb

- ◆ 100' of 1/4" tubing @ 15psig with a 2.5scfh = 1 minute
- ◆ With the same parameters, a standard 3" x 2.5" filter = 1 minute.
- ◆ Conditioning devices lag should not exceed 30 seconds.
- ◆ Transport lag should not exceed 1 minute.
- ◆ With the parameters above, the Sheffield Separators requires 7 seconds.

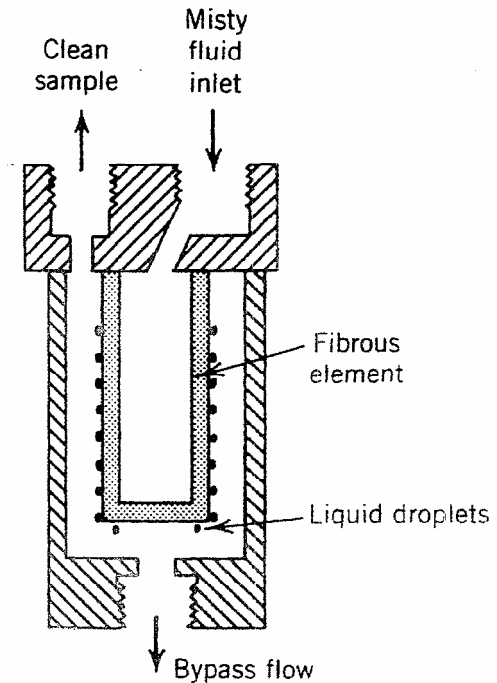
Filters

- ◆ Analyzers need filtration.
- ◆ To maintain a representative sample inert materials such as glass, stainless steel, ceramics and fluorocarbon are used.
- ◆ Small filter housing design for the slipstream is used to minimize replacement and lag time.
- ◆ Inside to outside flow is recommended for particulate removal and coalescing.
- ◆ Outside to inside flow suggested for slip stream sampling or removing bubbles from sample.
- ◆ Either manual, automatic, or continuous flow is recommended for all but particulate removal.



Cartridge Filters

- ◆ Too much lag time unless a bypass is installed.
- ◆ Miniature version is acceptable if vaporized with low particulate.



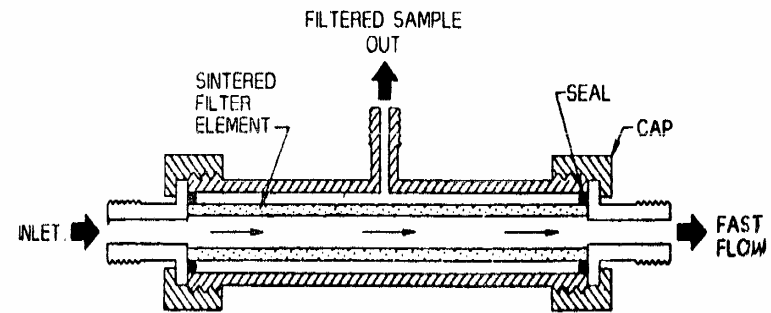


Back-purged Filter Probes

- ◆ If sample has very high particulate.
- ◆ Needs good back flush.
- ◆ “Best to avoid due to poor access.”

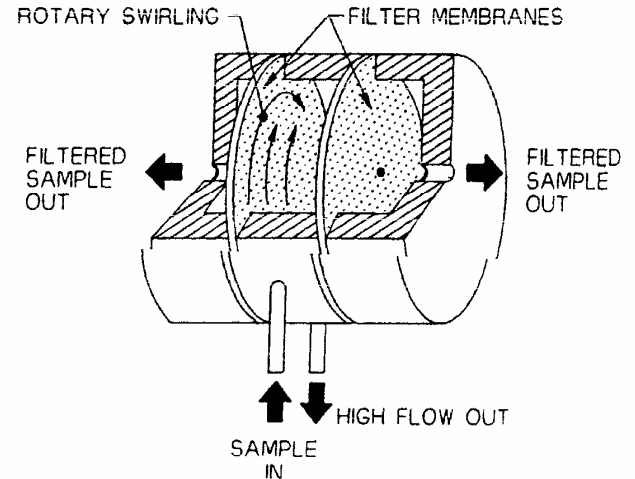
Cylindrical Bypass Filter

- ◆ Major sample flow passes axially through filter unimpeded.
- ◆ Analyzer sample exits at side port.
- ◆ Main flow provides scrubbing action for filter.
- ◆ With a flow 10 times the analyzer flow, the particulate impacts the filter at a shallow angle.



Centrifugal Bypass Filter

- ◆ Velocity of the process in a circular motion to clean the surface of a small membrane filter.
- ◆ The optimum flow rate (2-3gpm) should always be observed.
- ◆ High particulate concentration will increase pad replacement or failure.





Coalesce Filter Application

- ◆ **Creates torturous path.**
- ◆ **Wire meshes such as steel wool or custom fitted devices.**
- ◆ **Orientation is inside to outside.**
- ◆ **Membrane elements may be used for specific purposes. PTFE Teflon.**
- ◆ **Sample velocity must be kept low.**
- ◆ **The higher the phase density differential the greater the success rate.**

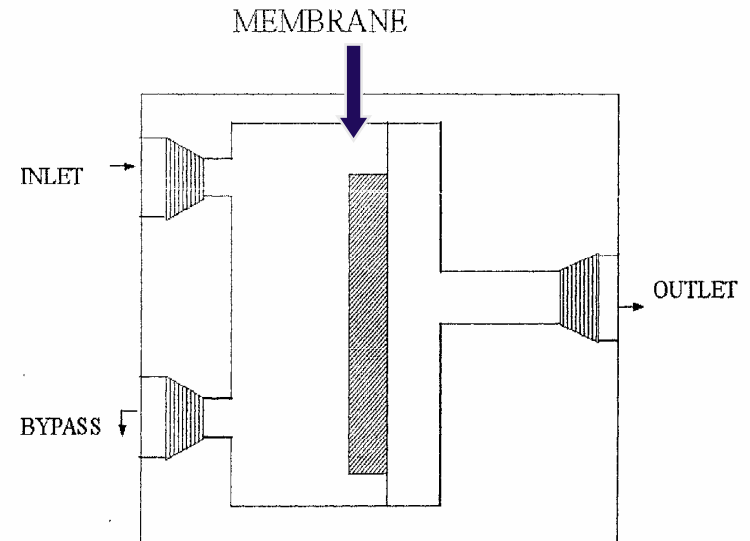
Sample Separators

- ◆ Sample separators are employed when sufficient contaminants exist to warrant separating the representative components from the contaminates.
- ◆ This is generally the case when filters alone cannot protect the analyzer.



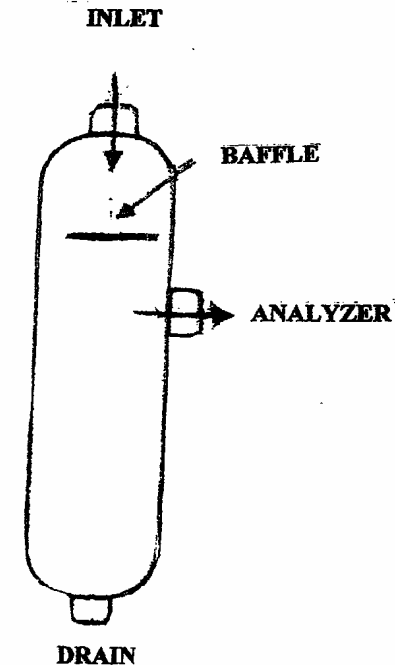
Membrane Separators

- ◆ Devices which use polymeric membrane to separate a specific component.
- ◆ Usually uses a low flow and low pressure circular flow.
- ◆ Allows certain components to permeate while others will exit the return.
- ◆ The membrane is submicron and will not tolerate particulates.



Knock Out Separators

- ◆ Reduces the flow velocity of vapors which allows the liquid droplets to separate.
- ◆ Main problem is the volume and thus the long lag time.

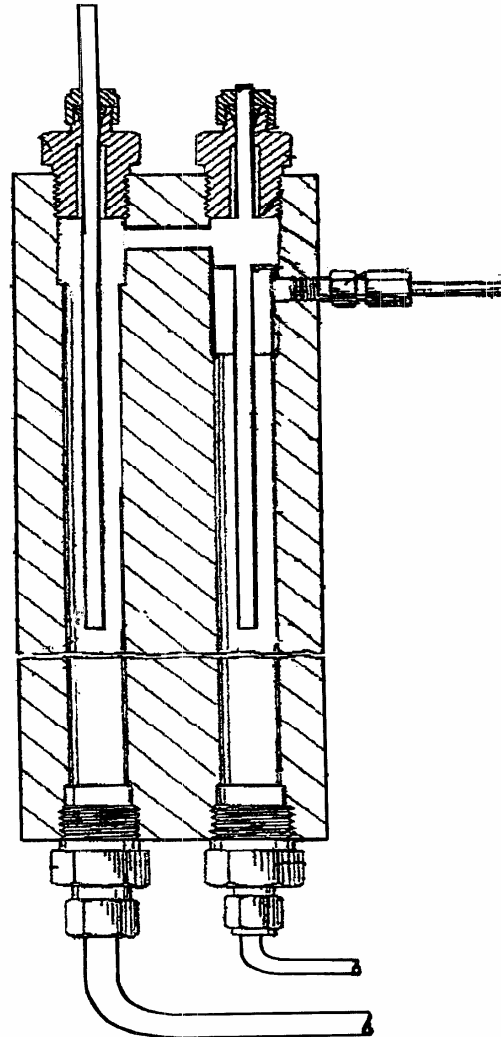




Kinetic Separation

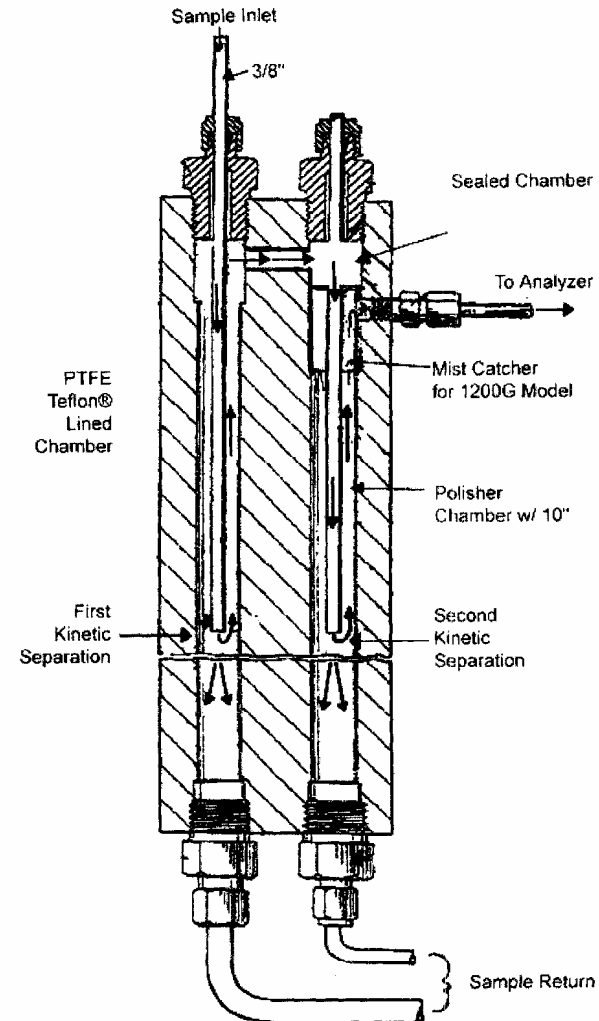
- ◆ **Inertia and gravity caused by a process flow allows the analyzer slipstream to reverse direction but prevents the entrained contaminants from escaping the main stream.**
- ◆ **The separator has one or more small cylindrical chambers with the flow traveling through the chambers in a vertical disposition.**

Kinetic Separation



Kinetic Separation Cont.

- ◆ An exit port is placed on the upper part of the chamber to force the slipstream to change directions.
- ◆ Can be used on liquid or gas separation.



CONCLUSION

- **Sample conditioning is the single most important installation consideration.**
- **80% of analyzer maintenance problems relate to sample handling.**



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