New, Safe, Simple, Standard practice to sample hazardous liquefied gas

The context: A sample by definition is "a small part of anything or one of a number, intended to show the quality, style, or nature of the whole." Therefore, the ultimate purpose of a chemical sample is to be REPRESENTATIVE of the batch that is being produced.

The more hazardous a chemical is, the more efficient sampling must be. Here efficient means "what does it take to grab a representative sample? ” The less steps required, the better it is. If purging / flushing can be avoided, safety is improved.

Therefore, the goal is to grab a directly representative the first time, each time.

Hazardous liquefied gases such as Chlorine, Liquefied Petroleum Gas (LPG) and others are toxic chemical where no exposure is allowed for the operator. Considerable effort is required to obtain a representative sample that will then be examined by various test methods to determine physical and chemical characteristics and conformance with specifications. Samples are usually collected in High Pressure Sample Cylinder.

Current Standard Practice are based on ASTM D1265 and have been established in the 1950’s. With new technologies and new regulations, those practice are now obsolete, especially for hazardous gases where personal safety is of utmost importance and external contamination must be avoided at all cost.

The problem: There is only two method to guarantee a representative sample:

1. Grabbing a directly representative sample using a device that has no dead space
2. Flushing or purging the residue in a system that has dead space.

When using a standard closed loop sampling systems, to avoid cross-contamination and guarantee a representative sample, it is necessary to purge and flush the system before and/or after each sample. By design, all closed-loop sample systems have dead space or dead volume, regardless of what misleading terminology the manufacturer of such system uses.

In other words, if a system has areas that are empty or not flowing while the system is at rest, then there is dead space.

Problems that may arise with purging/flushing include safety hazards, waste generation, additional steps for the operators, increased emission, additional piping, cross-contamination, numerous potential leak points and weak / unreliable fittings.

Closed-loop sampling systems are NOT intrinsically safe because purging/flushing is an operation that should be avoided.

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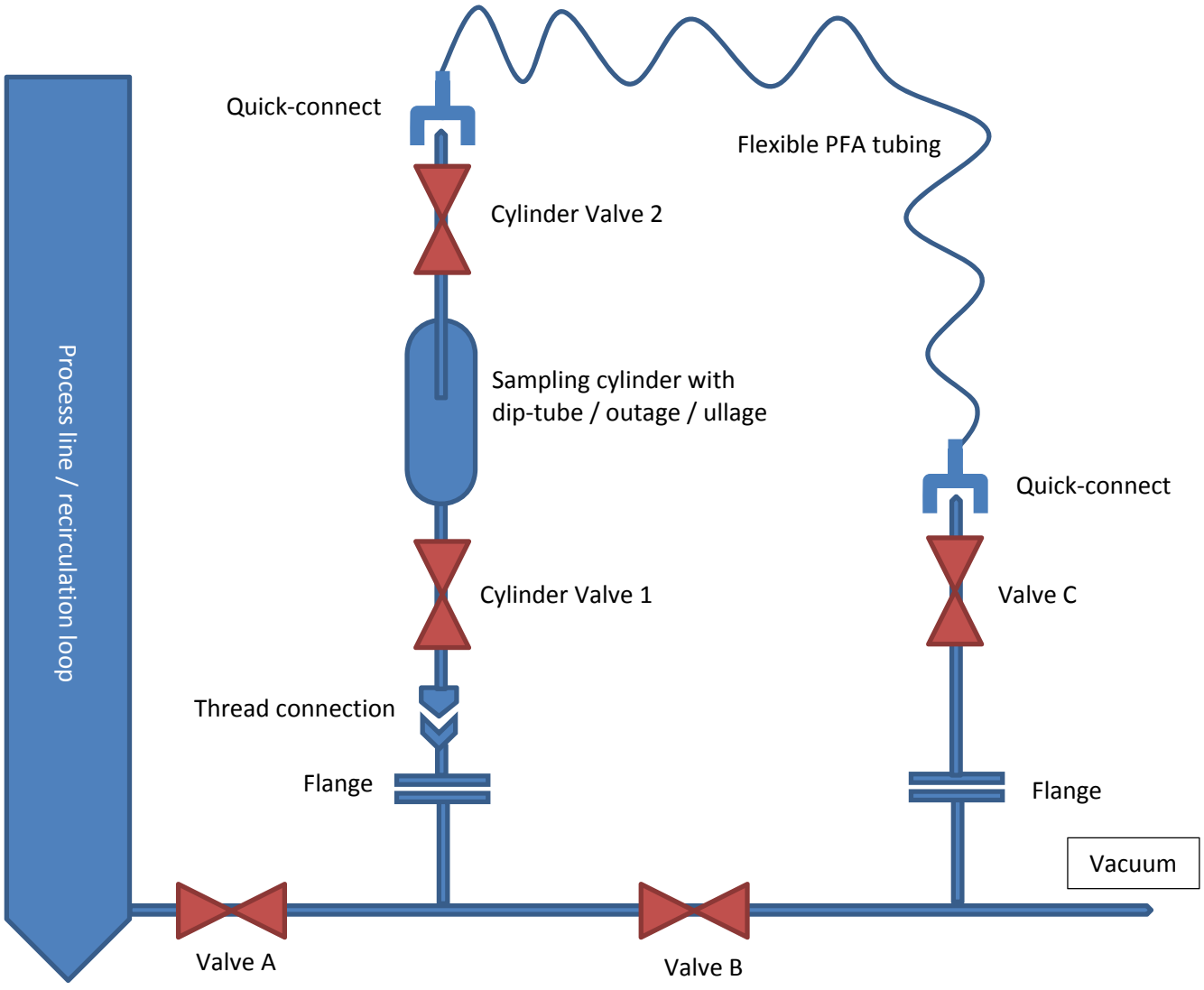
Example of Traditional system

The diagram below illustrates the complexity of sampling hazardous chemicals according to the Current Standard Practice based on ASTM D1265.

In summary, there is a lot of steps involved, it is important to follow the exact sequence to avoid product exposure, leaks and/or other safety problems.

Additionally, the product that is extracted from the process line and is not collected in the sample cylinder must be recycled in a safe way - this is in itself another challenging aspect linked to sampling.



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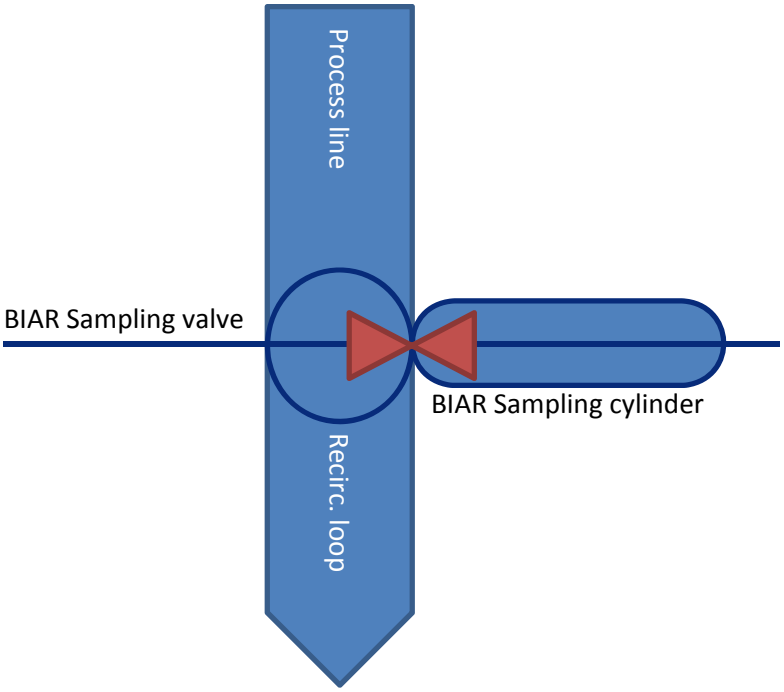
Proposal: Imagine a system where the sample is collected directly from the process line, without any intermediary valves or pipeline. Wouldn't this simplify the process, reduce potential leak points, increase safety – i.e. making it intrinsically safe - and improve the general quality of the equipment?

This New Technology has been developed and used exclusively for high demanding hazardous application. It is extremely easy to use and maintain.

Purely from the sample process point of view, the simplest and recommended way is to install the valve directly on the process line. The valve can also be installed on a ***fast loop*** between the high-pressure and low-pressure sides of the pump in a re-circulation line

This method represents less steps than traditional sample methods and each steps are intuitive. Furthermore, only the desired amount of product is extracted from the process line, thus eliminating the need to recycle unwanted residue. The following diagram illustrates the simplicity of this new technology:



Some differences with standard closed loop sampling systems include:

- Both the Sample Valve and Sample Cylinder can be fitted with bellows-type seals, providing perfect sealing and increased safety versus traditional stuffing box or other sealing technics
- To guarantee a representative sample, the sample cylinder must be prepared prior to sampling - it is not possible to flush it at the sample point.

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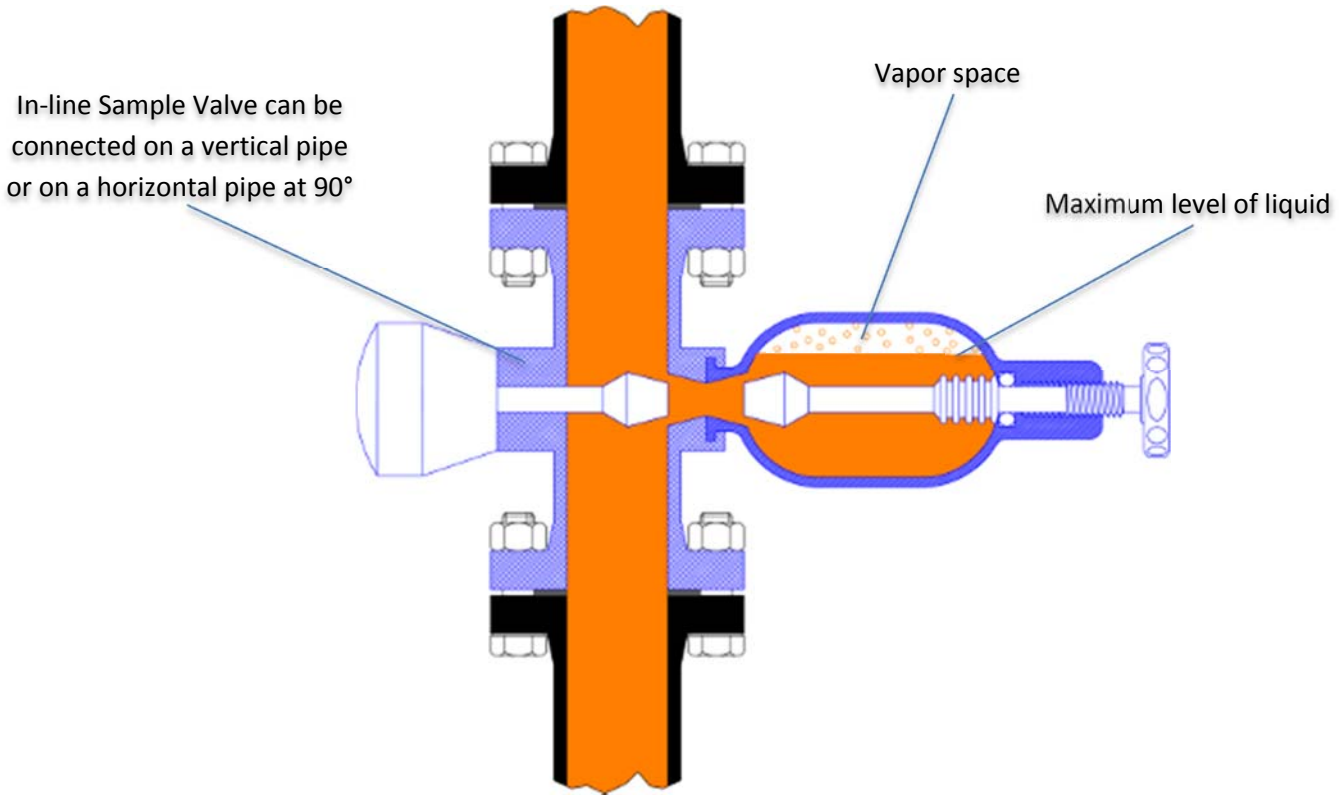
What about the minimum 20 % outage?

The following illustration shows how the sample container provide a sufficient vapor space to prevent overpressure from volumetric expansion.

An increase in temperature causes the internal cylinder pressure to rise by the combination of volumetric expansion of the liquid (compressing the vapor space) and an increase in the vapor pressure of the contents.

When used horizontally, the high pressure sample cylinder create a vapor space that is necessary for volumetric expansion of the liquid.



Use

Outage is the vapor space in the cylinder expressed as a percentage of the total volume of the cylinder.

% outage = (vapor space / total volume) X 100

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