17. Flare header gas sampler at atmospheric pressure

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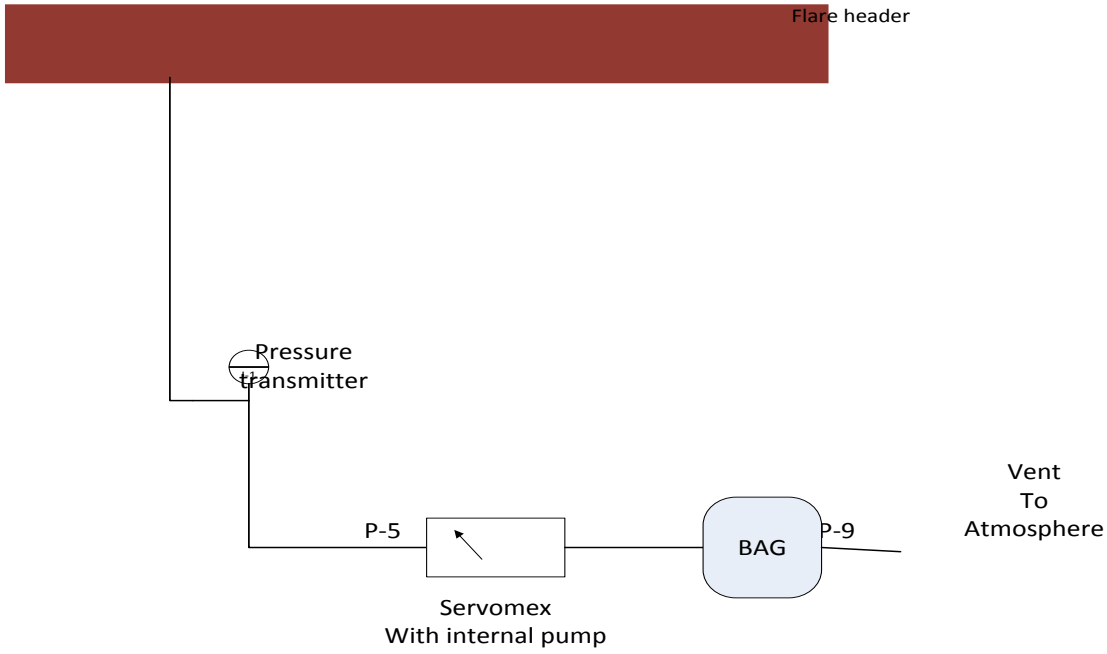
1 Introduction

At Kårstø we do have 5 flare stacks. Into these flare headers there are 7 ultrasonic flaremeters. The Government; Norwegian Environment Agency demand that there must be documented what's on the inside of the flare lines. It is accepted to take spot samples once a month to verify that the meters are operating correctly. Therefore, there is a need for a reliable sample system to get the spot sample out of the flare header without contaminating it with air or any other unwanted components. Also have a working environment that is acceptable 2017.

When having a permanent sampling system the quality of the sample will also have reduced uncertainty. In addition the sampling will be done faster which means that one will save time.

2 Problem

Today we are using tapping from a pressure transmitter drain and pump the sample out by means of a Servomex portable oxygen analysator with and internal pump.
SERVOFLEX Micro I.S 5100
The pump is capable to pump max 7ml/min.



The sketch shows the sampling done before the new sampler system.

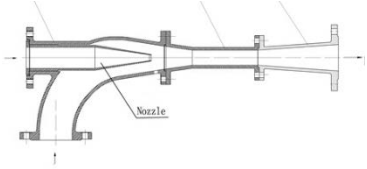
This is not the best solution and the gas is vented around the operator who is doing the sampling. To avoid gas to the atmosphere the vent should be returned to flare header. And if the working environment shall be mentioned it is not an accepted working position. Laying on their knees on the ground.

The picture shows the Servomex O_2-analyser and the sample bag.

3 Solution

3.1 Ejector

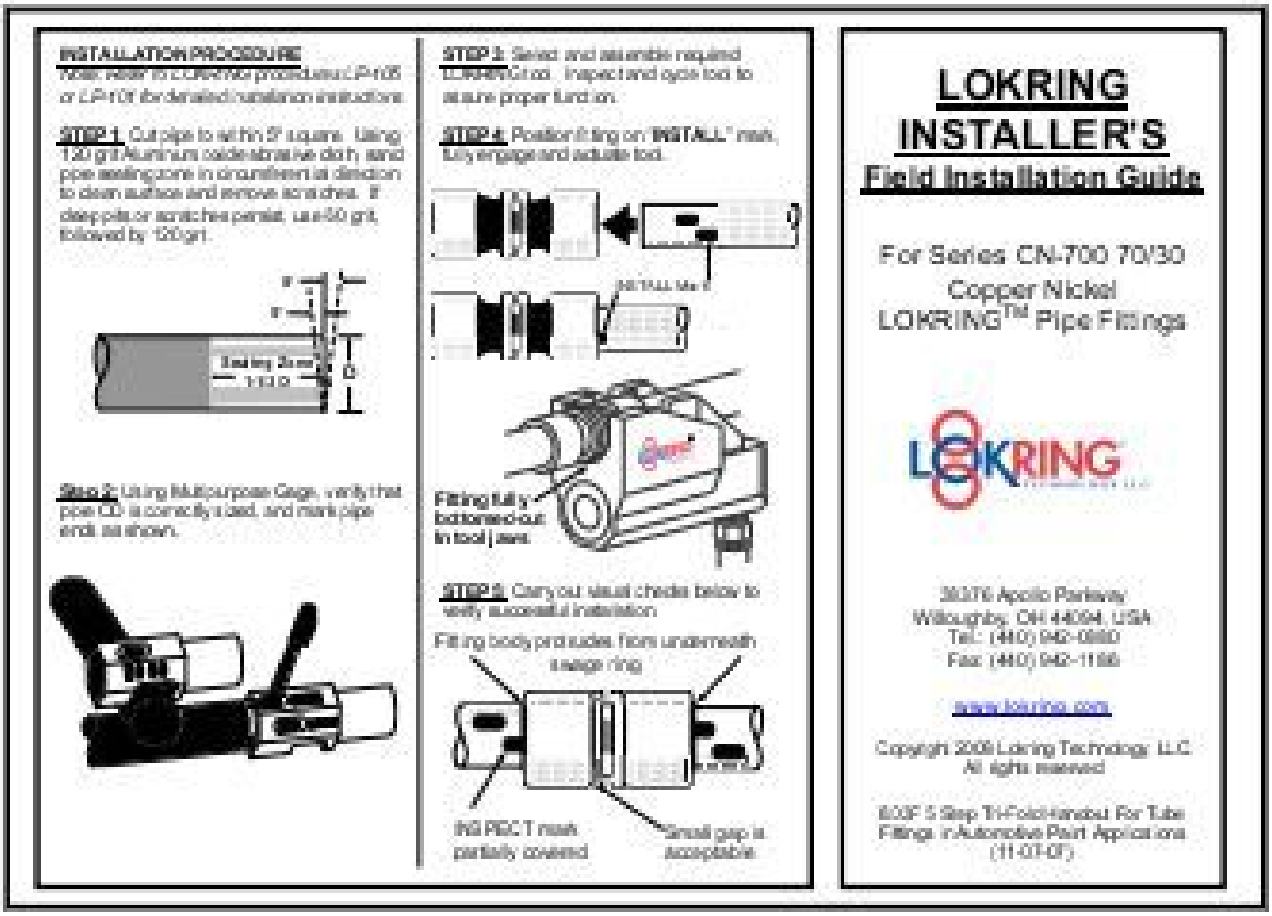
To get a better sampler system we found out that there is a need for a pump that can suck out gas from the flare header. Compress it and return the vented gas to the flare header. And in between we must be able to collect the gas into a cylinder.
We started up to consider several ways to sample from a non-pressurized system. An ejector will do this job that's for sure. If nitrogen was used as a "carrier gas" we could also return the gas to the flare header without any problem. If instrument air was used, we could not return this into the flare header again.



An ejector with nitrogen will do the job. But since the sample must be collected in the suction side of the ejector the sample will not be pressurized.

3.2 Air connection with Lokring

So if we could find a pump that can handle gas from atmospheric pressure and compress it to several bar and be driven by compressed air or compressed nitrogen. It would be perfect. Most of the pumps were electric driven. Use of elctric pumps would as a minimum double the cost. Compressed Air or N2 are located close to the location of the cabinets. When then using Lokrings pipe fittings we would avoid hot work permit.

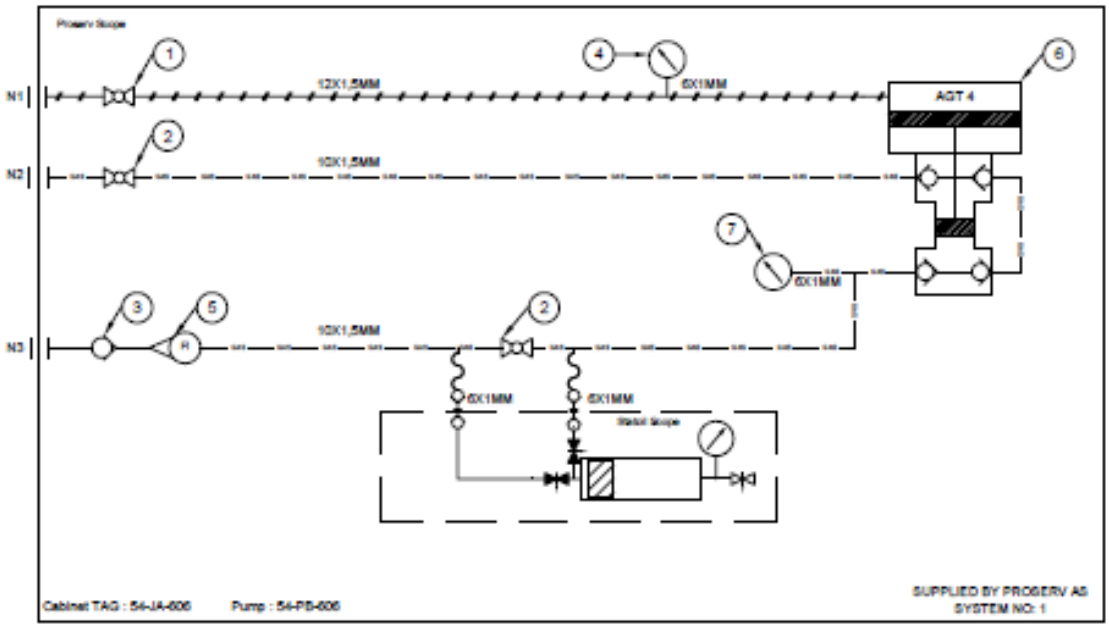


Picture is showing principle of Lokring and the way to install it

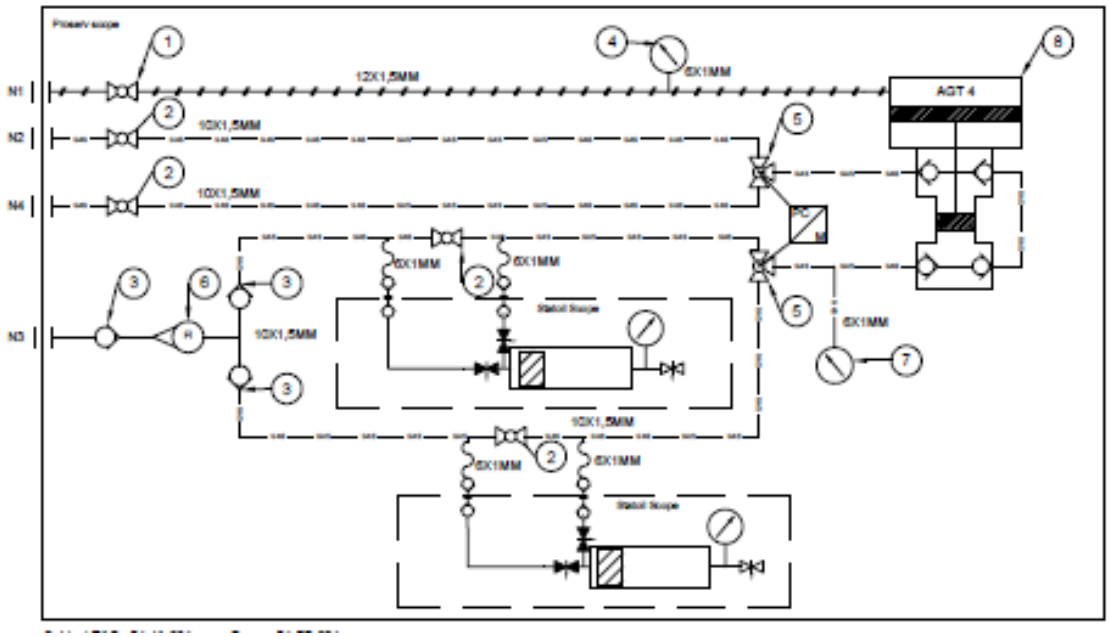
3.3 Pump

In cooperation with vendors we landed on a two-stage piston pump. The pump was tested in the work shop and it gave us just what we wanted. We managed to get a pressure of 8bar in the sample cylinder. Then the sample should be easy to be brought to the lab and injected into the Gas Chromatograph.

3.4 Design of cabinet

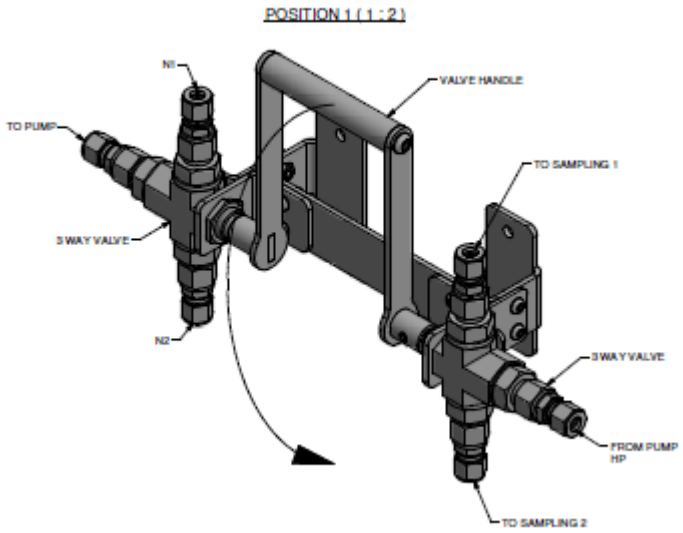


The Picture shows how the cabinet is constructed. This is for a single sample line



The Picture shows how the cabinet is constructed. This is for double sample lines. A double 3-way valve is used for selecting the corrct line with the correct cylinder.

3.5 Double3-way valve

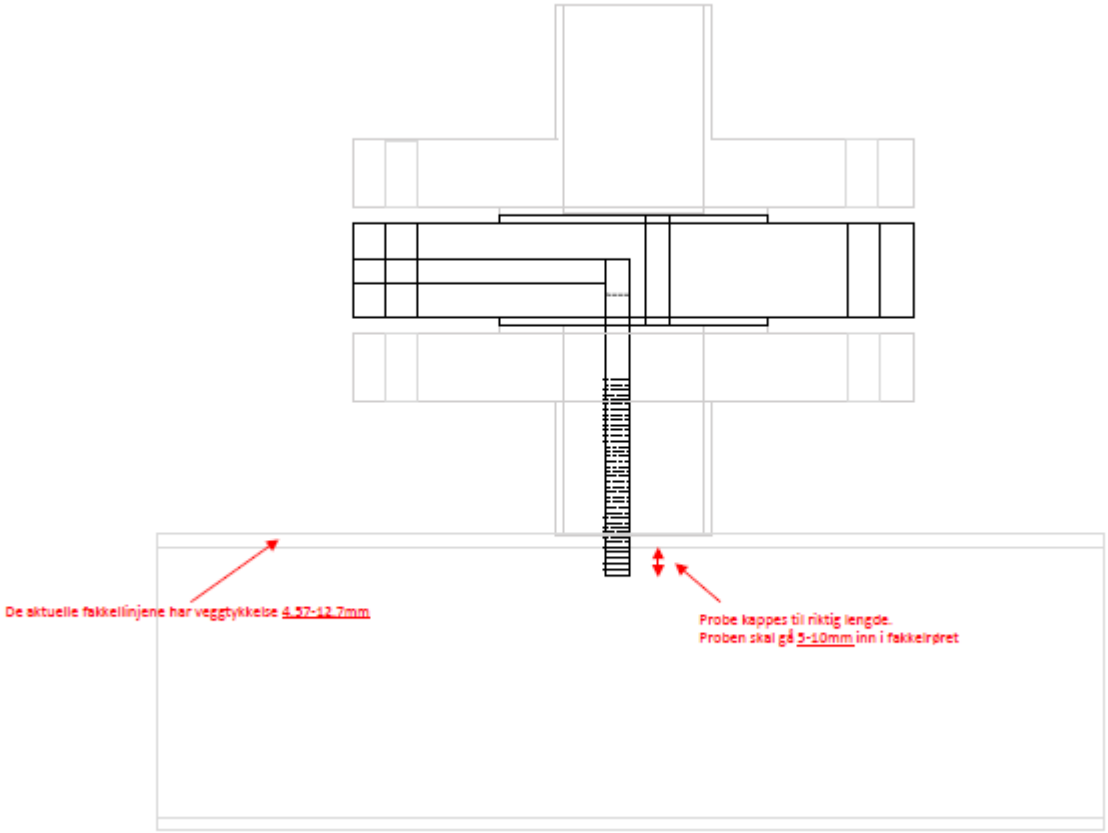


Picture showing Double 3-way valve

As indicated on the drawing there is a special double 3-way valve when selecting line and cylinder. This is to avoid wrong set up when sampling. And also connect both cylinders at start up.

3.6 Sample probe

Now the cabinet is designed. To get a proper sample we also need a proper sampling location. As told earlier the sample point was located on the vent on the pressure transmitter manifold. The tapping from the flare header is a 2” nozzle. What we fear is that droplets crawling along the inner pipewall easy can be sucked into the tubing and end up in the sample cylinder. To avoid this we constructed some special sample probes.



The probe was welded to a blind flange. There is a tapping on the side for the sample and a hole through the flange so that the pressure transmitter still can operate. The blind flange is inserted between the nozzle and the 2” piping valve for the transmitter. The length of the probe is adjusted such that the end of the probe is almost aligned with the inner pipe wall. The vented gas from the sampler is returned to the flare header further downstream. This also saves the environment and the operator. Now they don’t have to breathe in the fumes from the vented gas.

3.7 Shelter

Since the shelter for the sampler don’t have any electricity we found out that the best way to get a proper working light is to have perforated plates. This means that we will have enough working light and still protected from weather condition. And at last but not least reduced weight.

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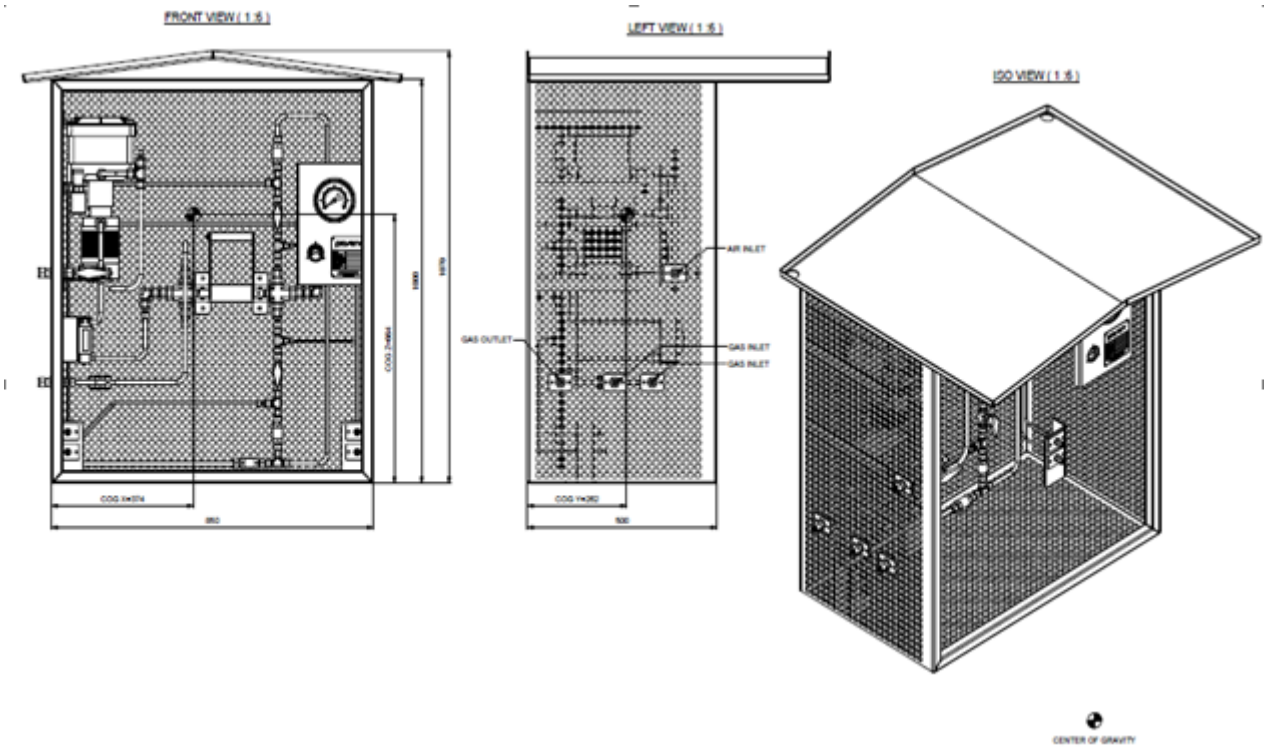

Picture showing the arrangement inside the weather protection with optimal access for the Laboratory Assistant.

Picture showing the shelter. Since the shelter is perforated there is enough light inside the shelter. Still the wind will be retardationed when going through the walls and therefore the enironment inside is quite nice.

4 Experience

Since the installation is delayed there is not much experience with the system. It has been tested in bench not connected to the flareline and it has delivered good result. Hopefully the presentation will have the experience from actual sampling.

5 Conclusion

5.1 Sampler bag

So instead of bringing the sample in a bag as above one can now bring it in a pressurized cylinder like the one below

5.2 Sampler cylinder

5.3 Summing up

- The quality of the sample is repeatable. The sample is fetched the same way every time. Since the pressure is way over atmospheric pressure it is less chance to contaminate it with air.
- It is now much easier to get a spot sample. And much faster.
- Much better working environment for lab personnel.
- Easier to increase number of samples pr month.
- Less uncertainty in the way of sampling.
- This solution will save time for the lab operator who is collecting the sample.
- The working position is a positive improvement. Now they can stand upright instead of kneeling down on the ground into the gravel.
- The excessive gas is return the pipeline instead of releasing it into the surrounding.
- The environment will have less pollution.

5.4 Location of the sampler cabinets

Location for sampler station

1. 2 sample points for low pressure flares
2. 2 sample points for pig sender and metering stations
3. 2 sample points for Process plants
4. 1 sample point for Process plant

6 References

Ejector http://www.hiseamarine.com
LOKRING https://www.yumpu.com/user/lokring.com
Samplercabinet http://proserv.com
Pump http://www.haskel.com/