Optimizing functional inspection of gas control lines with monitor set-up using PLEXOR®

In recent years, the need for more and qualitatively better test data from gas pressure regulator stations has grown significantly. There are several reasons for this, including optimisation of the quality of gas pressure regulating stations (GPRS), better insight into the functioning of the components used, the need for legitimately extending the period between maintenance, and recently; the global requirement to minimize the emission of methane.

The PLEXOR[®] inspection system offers the possibility of obtaining the desired data of the components in a GPRS in a digitized, semi-automated, standardised, reproducible and operator-independent manner. Each component is tested separately and dynamically, with the test data stored automatically and paperless on the laptop or tablet used for functional inspection.

The PLEXOR[®] inspection system is sold worldwide. In many countries double- or multi-line GPRS's are used in which the configuration of the gas pressure control line (GPCL) generally consists of an inlet valve, one or two Slam Shut Valves (SSV's), a gas pressure regulator, a (optional) Safety Relief Valve (SRV), and an outlet valve. An example of such a GPCL is shown in picture 1. Each of the components can be tested separately with PLEXOR[®] without having to change the set point values.



Picture 1: PLEXOR® test device connected via hoses to a typical GPCL with double SSV and single Gas Pressure Regulator

However, there are also many countries where so-called monitor set-up is applied; inlet valve, (optional) SSV, monitor regulator, working regulator, (optional) SRV, and outlet valve.

This article discusses how PLEXOR[®] can be used to separately analyse the SSV, the active gas pressure regulator and the monitor regulator in a controlled and repeatable way.

Measurement method.

Picture 2 shows the typical set-up of a GPCL with monitor set-up.



Picture 2: GPCL with monitor set-up

In picture 2 also the system couplings are shown which are required for connecting the PLEXOR[®] test device via hoses to the GPCL. The BMA05 and BMA06 are pressure measurement couplings, the BDA06 is a so-called diagnosis coupling, and it is mounted in the sensing line of the SSV. When it is not connected to the PLEXOR[®] inspection tool it is internally opened, and the SSV can sense the pressure in the outlet section of the GPCL. When it is connected via the hose it is in a closed position. This allows for testing the SSV tripping pressure in a unique way; by simply putting a lever in the activation mode on the PLEXOR[®] test device a standardized pressure increase of 1.5% of the outlet pressure is applied to the connection hose and the connection between the SSV and BDA06 coupling. In other words; the pressure in the outlet volume of the GPCL does not need to be increased to the tripping pressure of the SSV, thus eliminating the emission of methane when the pressure has to be equalized after the SSV has been activated. Similarly, the minimum set point of the SSV can be tested.

Following is tested of the SSV: 3* maximum tripping pressure, (if applicable) 2* minimum tripping pressure, valve leakage testing and leakage testing of the membrane chamber.

Prior to testing the SSV, usually the working regulator is tested. The procedure is done step-by-step and consists of following:

- 1. Measuring the gas network pressure.
- 2. Closing the outlet valve.
- 3. Opening the vent line.
- 4. Measuring the regulator set point.
- 5. Closing the vent valve.
- 6. Measuring the closing pressure of the regulator (twice)
- 7. Measuring the valve leakage of the regulator.

In step 4 the set point of the regulator is measured precisely. This value is important because for testing the monitor regulator, the setpoint of the working regulator must be increased beyond the setpoint of the monitor. Using PLEXOR[®] this can be done accurately in a controlled and visual way, using the software package INSPECTOR PC.

PLEXOR[®] measures dynamically with a measurement frequency of 10 measurements per second.

The PLEXOR[®] test device is equipped with two highly accurate pressure manometers (0,1% of reading). See picture 3



Picture 3: PLEXOR® test device, including manometers for measuring inlet- and outlet pressure.

When starting the procedure of testing the monitor an outlet pressure measurement is started. Picture 4 shows the screen that is presented on the laptop or tablet used by the operator.



Picture 4: switching from working regulator to monitor regulator

It can be seen that the measurement starts at the outlet pressure of the working regulator, then the set point of is gradually increased until the monitor regulator takes over.

Now that the monitor regulator has taken over control it can be tested in a similar way like the working regulator:

- 1. Measuring the monitor regulator set point.
- 2. Closing the vent valve.
- 3. Measuring the closing pressure of the monitor regulator (twice)
- 4. Measuring the valve leakage of the monitor regulator.

After testing the monitor regulator, the setpoint value of the working regulator must be decreased until its original set point. Like increasing the setpoint this can also be done in a controlled and visual way. This is shown in picture 5.



Picture 5: switching from monitor regulator to working regulator

In the left section of the graph the closing pressure of the monitor regulator is shown. At appr. 12:23:28 the vent valve of the GPCL is opened, and the pressure decreases to the set point of the monitor. Then the set point of the working regulator is decreased, and as of appr. 12:23:43 the working regulator starts taking over. Its set point is then further decreased until the original value measured in step 4 of the testing procedure of working regulator. The GPCL is now back in its original operating situation.

Next to showing the measurement procedure in a dynamic way, PLEXOR[®] also captures the data in an automatically generated report via the RESULTS software. This is shown in picture 5.

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Actual flow over ventilation:		990 mbar	1010 mbar	1006,5mbar
Lockup pressure 1:		1000 mbar	1050 mbar	1044,5mbar
Lockup pressure 2:		1000 mbar	1050 mbar	1031,7mbar
Leakage:		-5 mbar/min	5 mbar/min	6,6mbar/min
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		1st Technician:		Jeremy Deveney
		Name of 2nd Technician:		Jeremy Deveney
		Superv	Supervisor:	

Picture 5: Measurement report.

In the picture the initial setpoint of the working regulator (889,7 mbar) is highlighted in yellow. After testing the monitor regulator, the setpoint of the working regulator is re-adjusted (close) to its original value (887,2 mbar). This is highlighted in green.

Conclusion:

It has been shown that in a GPCL with working regulator and monitor regulator both can be tested separately in a controlled way. The actual procedure to increase the set point of the regulator beyond the set point of the monitor can be visually shown on the laptop/tablet of the operator doing the functional inspection. Afterwards the initial setpoint of the regulator and the re-adjusted set point of the working regulator after testing the monitor regulator are captured in an automatically generated report.

Advantages of using PLEXOR[®] for testing the monitor regulator:

- The initial setpoint of the regulator can be determined highly accurate
- The actual process of activating the monitor can be viewed dynamically using INSPECTOR PC
- The actual process of activating the monitor can be done in a controlled way
- The setpoint of the monitor remains unchanged
- Returning to the initial situation can be viewed using INSPECTOR PC
- The regulator can be adjusted exactly to the initial setpoint because of the high accuracy of PLEXOR[®]^{*}
- The regulator setpoint before and after testing the monitor is added to the RESULTS protocol

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