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Some aspects of quality and risk management for natural gaz meters

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Some aspects of quality and risk management for natural gas meters

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Abstract. The following paper refers to some general aspects regarding the measurement of natural gas. There are also presented the unauthorized intervention methods in natural gas distribution system and implicitly the fraudulent consumption of natural gas. It has been proposed to identify, analyze and respond to the risks involved in the measurement process, and to create a new natural gas meter by proposing an internal procedure set to prevent and reduce as much as possible unauthorized distribution. The measuring device is capable of preventing and detecting in real time unauthorized use of the distribution system. All these actions lead to changes in the competitive management process of the trading company involved in the distribution of natural gas

1. Introduction

Natural gas is a flammable gas, usually insipid and odorless, which can be found in the form of a deposit in the depths of the earth.

The science of measurements is based on the fact that the process of knowing the surrounding world relies on the experiment, that is, qualitative and / or quantitative assessment.

The strong development of all branches of science and technology has made the creation of new means and methods of measurement necessary.

Measurement is at present an essential component of any human activity, as it provides the quantitative information needed to make decisions about what needs to be done, as well as information on the results of the work done.

In industrial activity, ensuring quality control of products requires permanent measurements, both on all materials used in production and on the benchmarks following each operation and on the finished products themselves.

In the operation of exploring complex installations, for monitoring of operating parameters and for the inspection of performance maintenance, as well as to ensure the safety of the installations and the protection of the work, permanent or periodical repairs are undertaken.

Tracking consumption of raw materials, energy and fuel and taking saving measures requires the use of measuring instruments. Trade towards the population, business-to-business transactions and management of stocks can only be achieved on the basis of increasingly complex measurements.

Analyzing the process of distribution and measurement of natural gas consumption results in unauthorized, fraudulent interventions of some people with training, these interventions presenting special risks, some related to the safety of the functioning of the installations the health of people



exposed to intoxications and / or explosions.

That's why we need to develop high performance equipment to minimize these risks and also through a high performance management, to elaborate a set of procedures involving all the factors, all of which lead, first of all, to the safety of the functioning of natural gas installations and, implicitly, of the people.

2. Unauthorized intervention methods on gas meters

During the inspection of the maintenance and operation of the distribution system, various types of fraudulent intervention methods have been identified: damage to the meter mechanism or its replacement, blocking of the recording mechanism, punching through the outlet of the metering chamber, measuring through the input device of the meter, opening in the cover of the recording mechanism, reversing of the meter device (counter-clockwise), counterfeit metrological marks, damage to the metrology marks, etc.

In an absolutely natural way, only a few of these interventions are presented in the paper, taking into account the ingenuity of those who, consciously, bring "contributions" to the subsequent development of the meters. This way, the closed loop of the supplier and the consumer is dynamic, the supplier must be constantly alert to unauthorized interventions. This is done by creating simple procedures, some of a general nature, others more specific, capable of being constantly in line with market requirements. Therefore, not only the performance design of gas meters should concern the attention of natural gas distributors, but also the creation of a legal, rapid intervention systems for the detection of some offenses.

2.1. *Unauthorized intervention by locking the gear lever of the recording mechanism (meter)*

A frequent intervention at the consumer is made by inserting some foreign bodies through the inlet of the measuring device to lock the lever that engages the recording mechanism.

Throughout the process, the natural gas meter has been completely blocked.



Figure 1. Locking the engagement lever of the recording mechanism

This is visible at present only when reading consumption, nonexistent to the consumer, although there is physical activity. Hence the need to create a system that quickly highlights any blocking of the recorder, when the device is in use and the recorder is stationary.

2.2. *Unauthorized intervention by reverse installation of the meter device*

Another unauthorized intervention commonly encountered in "practice" is the reverse installation of the meter, facing the wall (the inlet / outlet connections are reversed), having the effect of reversing the gas in the measuring apparatus and, implicitly, a negative recording of the consumption.

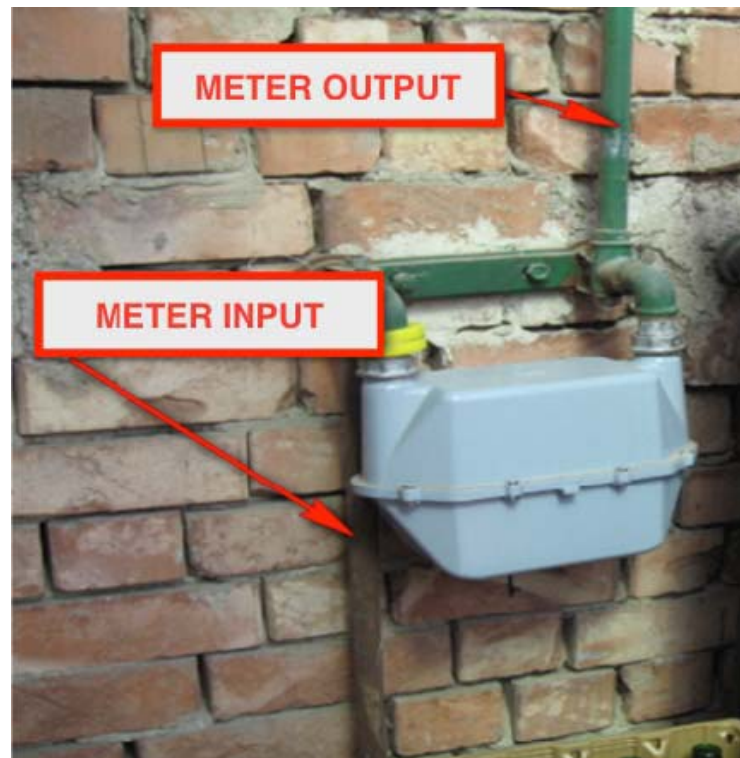


Figure 2. Reverse installation of the meter device

Such an intervention, as shown in Figure 2, is visible, so through a visual inspection can be detected and take counter-measures. Here, in this case, procedures are required for inspecting and ascertaining the state of functioning of the consumers. But also by designing a system for measuring pressure and direction of gas through pipelines and connecting it to a centralized recording system, fraud can quickly be detected.

2.3. *Unauthorized intervention by executing a hole into the measuring chamber through the inlet of the gas meter*

This method influences the correct measurement of natural gas consumption and implicitly causes a jerky / uneven operation of the measuring apparatus. It consists in making a hole in the measuring chamber through the inlet of the measuring tool. And in this case, a procedure leading to the monitoring of consumption at the point of distribution, which would allow a quick intervention, would lead to a reduction of the breaches due to fraud or the losses of the natural gas supplier by recording the correct consumption.

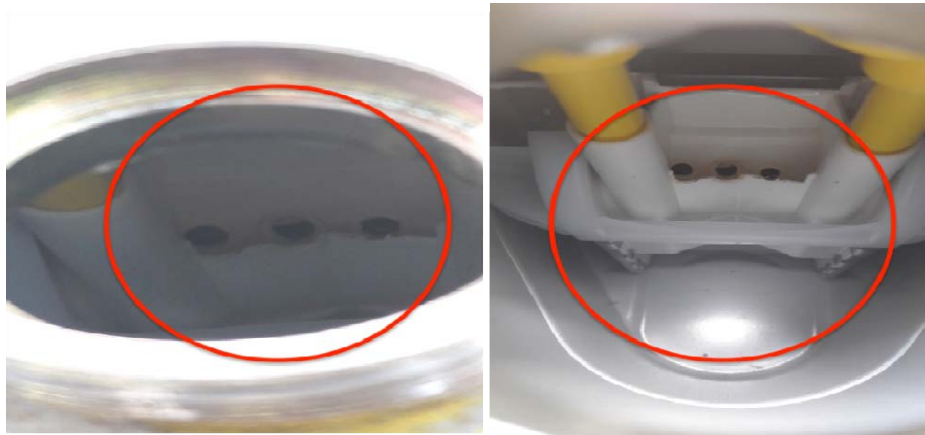


Figure 3. Hole in the measuring chamber through the inlet connection

2.4. *Unauthorized intervention on the integrator caps and fasteners*

Removing the protective plugs and mechanical fastener bolts is a frequent intervention.

By doing this, the measurement becomes uneven, due to piling, cutting of the pins or due to the replacement of some parts of the integrator.

The mechanical index of the measuring device can be changed (backwards), through direct access inside the meter.

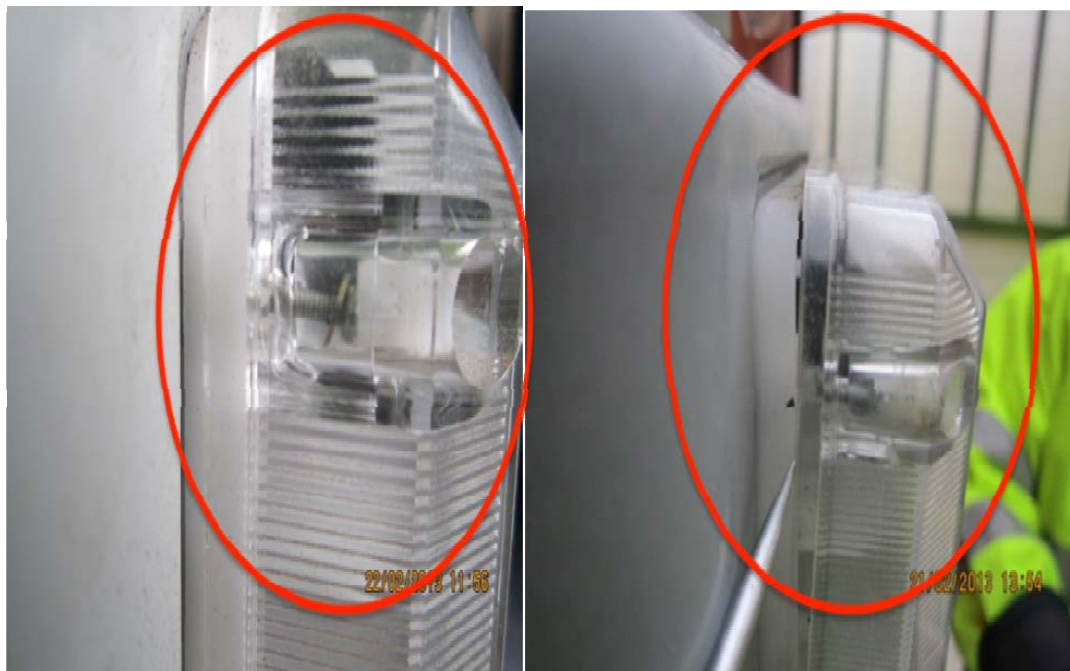


Figure 4. Detach the integrator

In this case, the intervention of the consumer is easily visible, and through the periodic inspection the losses can be reduced.

3.Procedures

Natural gas metering devices are built on quality and technical norms that must allow accurate measurement of natural gas quantities.

From the above, it can be seen that there were interventions of all types on the measuring instruments, this being forbidden by law.

Natural gas theft is a crime and is punished according to law number 123 of 2012.

The desired quality of the metering device requires a risk analysis to identify existing or potential problems.

Risk management aims to manage threats that could have a negative impact on the company.

Thus, it is proposed to create a measuring apparatus that highlights the actual consumption and alerts the supplier quickly about unauthorized interventions on the measuring devices.

In order to improve the maintenance and designed activity of natural gas metering devices, the organizational management proposes to develop a set of internal procedures that prevent and limit as much as possible the unauthorized consumption of the distribution system, as follows:

3.1. For unauthorized interference by locking the engagement lever, by execution of an orifice in the measuring chamber through the inlet / outlet connection, by-pass is proposed:

- Installing sensors on the inlet and outlet connections so that a silent alarm is triggered when the meter is removed from the installation;
- The possibility of real-time detection of unauthorized use of natural gas and its forwarding to the reading compartment;
- The possibility of fast intervention in the place where the unauthorized consumption occurs;
- Development of a procedure where communication between departments is optimal and fast;
- Developing a collaboration procedure between the company and the Police.

3.2. For unauthorized intervention by reverse installation of the meter device, it is proposed:

- Mounting a gasket locking system to the reverse flow of the gas together with a throttle;
- Installing sensors on the inlet and outlet connections so that when the measuring device is being dismantled from the installation, a silent alarm will be triggered and the alarm can only be stopped by authorized distribution company personnel;
- The possibility of real-time detection of unauthorized use of natural gas and its transmission to the reading compartment;
- The possibility of rapid intervention in the place where the unauthorized consumption occurs;
- Development of a procedure where communication between departments is optimal and fast;
- Developing a collaboration procedure between the company and the Police.

3.3. For unauthorized intervention on protective plugs and fixing bolts, falsification / deterioration of metrological batches, it is proposed:

- Construction of a natural gas meter that has the integrated recording mechanism in a metal housing/casing, without the possibility to reach the internal elements of the integrator, by falsifying / damaging the metrology marks;
- The possibility of real-time detection of unauthorized use of natural gas and transmission to the reading compartment;
- The possibility of rapid intervention at the place where unauthorized consumption occurs;
- Development of a procedure where communication between departments is optimal and fast;
- Developing a collaboration procedure between the company and the Police.

3.4. For unauthorized intervention by the creating of an opening in the cover of the recorder mechanism and the insertion of a needle / wire, aiming to stop the measuring process, it is proposed to:

- Installing a pressure sensor inside the integrator that triggers a silent alarm when the hole is

being drilled;

- Construction of a natural gas meter that has the integrated recording mechanism in a metal housing/casing, without the possibility to reach the internal elements of the integrator, by falsifying / damaging the metrology marks;
- The possibility of real-time detection of unauthorized use of natural gas and transmission to the reading compartment;
- The possibility of rapid intervention at the place where unauthorized consumption occurs;
- Development of a procedure where communication between departments is optimal and fast;
- Developing a collaboration procedure between the company and the Police.

4. Conclusions

As a result of this analyses , one can notice that there are many methods of unauthorized intervention on natural gas meters.

Thus, a process of identifying, analyzing and responding to the risks in the natural gas measurement process has been proposed.

It is proposed to innovate a new gas meter, focusing on the quality of the new product and its ability to prevent unauthorized use.

The new measuring device is capable of preventing and detecting in real time unauthorized use of the gas distribution system.

The advantages of improving the measuring device are as follows: reducing natural gas losses, reducing unauthorized consumption, an easier control of the measurement / reading / billing process, increasing the revenue of the distribution company, credibility, improving the image of the company producing measuring devices, differentiation from competition, facilitation of bidding and last but not least safe exploitation and increased customer satisfaction.

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