

Review of the Technical Metrological Regulation for flow computers and volume converters

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Abstract: With the publication of Inmetro's regulation n° 373/2014, Inmetro presented the proposal to review the regulation of flow computers and volume converters, whose scope now includes fiscal measurement, ownership, custody transfer, among others, of hydrocarbons liquids and natural gas. This new proposal provides improvements to the legal metrological control of these instruments in Brazil, while also broaden the scope from the previous regulation, the Inmetro's regulation n° 64/2003. The purpose of this paper is to present these changes from a metrological point of view, and also clarify the transitional rules for the process.

Keywords: flow computer; volume converter; regulation; legal metrology.

1. INTRODUCTION

Flow computers are calculating devices used within fluid measurement systems. They functionality is to perform volume conversion, as well as total value summation. Temperature and pressure typically varies in a pipeline flow in many different situations, such as exploitation, transportation and storage. The use of flow computers allow a proper mathematical assessment of the actual volume, regardless of the atmospheric condition the fluid is at a moment. The assessment is based on the law, in the case Brazilian, item 3.8 of the Joint Resolution ANP / Inmetro No. 01/2013 [1]. The legal atmospheric conditions are temperature of 20 ° C and pressure of 0.101325 MPa. The standard measurement condition may vary according to a specific trade contract, and in this case a flow computer plays a key role as well. Therefore, flow computers are electronic devices similar to cash registers for oil

and gas trade [2]. Figure 1 illustrates a typical setup of such equipment at a measuring point.



Figura 1: Typical flow computer connexion to a pipeline and a flow measurement system.

Source: drawn by the author.

As illustrated, flow computers are fed with pressure and temperature transduced signals, and compile that information with the flow measurement input. A chromatographer (in the case of gas flow) or even a densimeter (for petroleum flow, for instance) could be included in the measurement system.

2. LEGAL METROLOGICAL CONTROL

According to the International Vocabulary on Legal Metrology (VIML, [3]), the legal metrological control comprises a pool of activities aiming to assure the metrology quality of a device or service.

Presently in Brazil, the legal metrological control of flow computers is based on the rules established in Inmetro's normative n° 64 [4]. The main metrological tests to be performed are the following:

- Pulse totalizing; dissimilar and pre-defined waveform are inserted into the flow computer, and the correctness of their computation is evaluated;
- Temperature and pressure input signals; analogic waveform type 4 (@ 20 mA) and type 1 (@ 5 V) are used to generate sensors output, and its performance and reliability is evaluated afterward;
- Simulation of a complete measurement arrangement, using standardized equations according to [5][6].

3. REGULATORY REVIEW

As aforementioned, flow computers are regulated with regard to its metrological aspects according to [4]. The legal reference to that normative was the Joint Normative Inmetro/ANP n° /2000 [7]. The scope of the regulation was proposed to cover the main technical aspects of such kind of devices and related measurement systems.

A further step toward the technical enhancement of the mandatory regulation was settled within the Join Resolution ANP/Inmetro n° 01/2013 [8]. That revised regulation defines many mandatory activities to Inmetro, which includes the necessity to renew the flow measurements metrological regulation. The importance of such revision is that

flow computers, and flow measurement system as a whole, are fundamental for custody transference for the industry of oil and gas.

Aiming to adapt to the new legislation [8], Inmetro started a technical discussion with the goal to revise the Technical Metrological Regulation (RTM, acronym in Portuguese) for flow computers and volume correction devices. The Inmetro's normative n° 373/2014 was issued in August 13th [1]. It includes a RTM draft, which represents the result of the hard work developed within the Technical Commission on Legal Metrology (TC/LM) for flow computers. That TC/LM was organized by Inmetro, and their members were many important stakeholders from oil and gas industry. That normative will supersede the presently valid regulation ([4]) according to a scheduled discussed further in this paper. Inmetro's normative n° 373 diverges in its scope from the former as it covers exclusively flow computers and volume correction devices for measuring oil and gas. Previously [4], the scope embraces all measurement devices applied to petroleum and their liquid products, as well as anhydrous and hydrated alcohols used as fuel.

3.1. MAIN TECHNICAL CHANGES

Metrological requirements present in [1] were not significantly changed as compared to what was previously determined in [4]. The maximum admissible errors remain the same. However, inspecting the new RTM in deep, one can observe that the testing structure changed in such level that it cannot be considered similar to what is presented in the International Organization for Legal Metrology (OIML), as disclosed in OIML R117-9 [9]. That international document was formerly used as the technical base for Inmetro's normative n° 64/2003 [4].

On the other hand, RTM's scope and metrological control for outdoor measurement

were remarkably changed with the new regulation. The former document comprises petroleum measurement, what was preserved in the new document. However, metrological control shall now cover measurement system for gas flow in particular productive arrangements. Those productive arrangements are exploitation and production of gas and oil according to what is defined in [8]. It is worth mentioning that this document ([8]) does not cover natural gas, thus flow computers do not demand type evaluation as defined by OIML and Inmetro.

Finally, the new RTM establishes a mandatory the type (pattern) evaluation, i.e., conformity assessment procedure on one or more specimens of an identified type (pattern) of measuring instruments which results in an evaluation report and / or an evaluation certificate [10]. An initial verification is also mandatory, and it shall be undertaken by state institutes delegated by Inmetro (IPEM) for every device prior to its commercialization. However, subsequent verifications were not defined as mandatory to the governmental metrological system (Inmetro and IPEM). The final user, or the instrument owner, is in charge with the periodic verification. In that sense, the legal metrology control is finished after the device has been sold.

3.2. TRANSITIONAL RULES

In order to minimize the impact due the new regulation in the industrial sector of oil and gas, Inmetro has introduced transitional rules in the normative itself. Measurement systems which type approval had already been issued will have their certificate valid for additional 12 months, as soon as the new normative is issued. Further on, their certificates will be withdrawn.

Due this systematic, dealers, manufacturers or commercial representatives are legally authorized to sell the measurement system with a previously

issued certification. Meanwhile, a new type approval for their devices shall be demanded to Inmetro. No infraction is due to any final user that had bought a measurement system with a type approval issued during the transitional schedule. The validation of data is assured within the normative.

4. CONCLUSIONS

With the technical revision of the RTM related to the Joint Normative ANP/Inmetro nº 1/2000 [7], the regulation regarding flow measurement system was changed. It affects mainly flow computers and volume converters.

Within the present paper, the main technical aspects, which concern the subject, were disclosed. Summarizing:

- Now the regulation explicitly defines the demand for type approval of flow computers, differently from what was formerly the case; just complete flow measurement system were under the metrological control;
- The scope of fluids possible to be measured was expanded, once natural gas had been included;
- Presently, the metrological control is restricted to type (pattern) evaluation and an initial verification, whilst the subsequent verification is of responsibility of the final user.

It is an intrinsic objective with the new RTM issue to let the metrological control, as realized in Brazil, updated. That document is coherent with the vision of minimum interference on industrial and trade affairs, but still acting close to the main technical and metrological aspects of a certification and type approval of measurement systems.

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