

Regulamentação de computadores de vazão para a medição de biocombustíveis

Regulation of flow computers for the measurement of biofuels

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Resumo: Este artigo tem como objetivo discutir a necessidade de desenvolvimento de uma norma ou regulamentação aplicável a computadores de vazão na medição de biocombustíveis. São apresentadas normas e recomendações internacionais possivelmente adequadas a preencher esta lacuna e ao final do artigo é apontado um caminho para obter-se um documento único sobre o tema.

Palavras-chave: regulamentação, computador de vazão, biocombustível.

Abstract: This article aims to discuss the need to develop a standard or regulation applicable to flow computers in the measurement of biofuels. International standards and recommendations are presented which are possibly adequate to fill this gap and at the end of the article a way is proposed to obtain a single document on the subject.

Keywords: regulation, flow computer, biofuel.

1. INTRODUCTION

With the publication of the Inmetro's Regulation nº 499 of 2015, this Institute established a metrological technical regulation (RTM) of flow computers and conversion devices, whose scope includes fiscal measurement, appropriation, custody transfer, among others of liquid hydrocarbons and natural gas. This new proposal presents several improvements to the legal metrological control of these instruments in Brazil, while also expanding the scope when compared to the previous regulation.

However, these devices also possess the functionality, and are in fact used, to mathematically and continuously convert

volumes of biofuels (ethanol and biodiesel) (1), which will not be covered by this new regulation. What we have here is a real need to regulate the measurement of biofuels with the use of conversion devices. Not only due to the large volume of transported product (2) but also due to the publication of the "Strategic Guidelines for Brazilian Metrology 2013-2017" (3), by the National Council of Metrology, Standardization and Industrial Quality (CONMETRO). This resolution, which guides the actions of the several Brazilian metrology institutions, as well as the application of governmental resources for the effective development of metrology in the country, stipulates that it is up to the legal metrology services to expand their performance

in order to incorporate the demand for measurement of, among others, the biofuels market. Considering that legal metrology can cover only measuring instruments that are subject to metrological technical regulations issued by Inmetro (4) and that such regulations are usually based in national and international standards and recommendations, a problem arises.

There are currently no standards or recommendations with requirements applicable to these conversion devices in the measurement of biofuels. This article aims to discuss the use of standards applicable to other fluids and devices to fulfil this role, notable: the OIML R22 (5) and ABNT NBR 5992 (6) for ethanol, the ABNT NBR 15512 (7) for biodiesel, the OIML R117 (8), WELMEC 10.4 (9), ABNT NBR 16020 (10) and API MPMS 21.2 (11) for measurement systems. Some comments should be made on each of these standards in addition to the regulation currently in vogue for these devices.

2. INTERNATIONAL STANDARDS AND RECOMENDATIONS

a) OIML R22 places great emphasis on the use of tables for the conversion of ethanol volumes, but it is the knowledge of the formula that generated these tables that should be available for use in flow computers. This is due to the fact that the formula will be programmed into the flow computer as a mathematical model for ethanol conversion. Thus, this OIML recommendation could be used, within the context of a metrological technical regulation, as a mathematical model. In contrast to the physical standard, the mathematical model exists only as an equation, but allows the comparison between the value of a measurement obtained by the instrument and the expected value according to the equation;

b) OIML R117 presents technical and metrological requirements applicable to fluid measurement systems, but throughout its contents there are also requirements applicable to flow computers. Maximum permissible errors, test approaches, requirements for physical and electronic sealing, requirements for associated measuring devices, and requirements for the installation of the flow computer are mentioned. The latter type of requirement is the reason why this recommendation cannot be fully validated as the installation requirements in the system cannot be observed. In a deeper analysis, only the physical and electronic sealing requirements, test approaches and maximum permissible errors can be validated in a hypothetical regulation for biofuels measurement in flow computers;

c) WELMEC 10.4 guide is presented as an add-on to R117. Initially developed by WELMEC in order to address concerns that arose in the recommendation application. This document acts as a guide for R117's application on conversion devices. In addition to the test approaches presented by the recommendation, it suggests a new approach, which allows for a more flexible application of this guide according to the assembly of the conversion device and its associated measuring devices, as stipulated by the manufacturer. In addition to this new approach the guide also presents what may be considered an omission in R117 for flow computer essays: a complete detailing of tests for this device with numbers of points to be checked in each test, specific tests to be performed according the device approach and reference values for calculating the maximum permissible errors;

d) Focusing on ABNT NBR 16020: 2011 requirements, exclusively applicable to flow computers, it can be observed that this standard provides much more robust information than, for instance, WELMEC 10.4. This is due to the fact that the 16020 recommends specific standards for

calculating the volume conversion of fluids. Item is absent from WELMEC 10.4, which is complementary to R117. Also noteworthy is the presence of specific sections on calculation algorithms for the measurement of biofuels. Although R117 and WELMEC 10.4 already recommend a document for conversion of volumes of ethanol (OIML R22), ABNT 16020 goes further and recommends, in addition to a standard for the conversion of ethanol (ABNT NBR 5992), a standard for the measurement of biodiesel (ABNT NBR 15512);

e) Like the OIML R22 recommendation, ABNT NBR 5992: 2008 presents a mathematical model for ethanol and its mixtures with water volume calculation. In this case the standard stipulates the whole procedure and laboratory equipment for the tests to determine the specific mass and the alcohol content of the ethanol and water mixture. Part of this process involves using the values determined experimentally in the "Programs of Alcoholic Tables" software, supplied in full with the standard. Thus, the standard can be considered more appropriate to the use in flow computers than the OIML recommendation, since, not only presents all the subsidies for the accomplishment of the tests to obtain the specific mass, but also has an updated mathematical model for insertion into the programming of the conversion device;

f) Although it is indicated by ABNT NBR 16020 as a reference for the biodiesel conversion of its specific mass due to the effect of temperature, ABNT NBR 15512 only mention it briefly. The standard only directs the reader to consult the conversion table used for petroleum in Brazil, in this case the Resolution of the National Petroleum Council No. 6 of June 25, 1970. Although the scope of this resolution is the conversion of volumes of crude oil, it is also used, as recommended by 15512, for conversion of biodiesel. No further mention of volume conversions is made throughout the document;

g) API 21.2 focuses on requirements applicable to liquid measurement systems. Although, in this standard, these systems are used for measurement of liquid hydrocarbons, some unique requirements for flow computers can be extracted. Among them we have: Audit trail requirements (especially configuration report, events and alarms);

- Requirements to be observed before the acquisition of the conversion device;
- Requirements for its verification.

This standard does not clarify maximum permissible errors, types of tests nor even details of the minimum number of points to be collected or provides mathematical models for the measurement of biofuels. However, it provides specifications of measurement standards that should be used to test all components of a liquid metering system, including the its flow computer;

h) Inmetro's Regulation N°. 499, of October 2nd, 2015, presents the technical metrological regulation applicable to the measurement of oil and gas in flow computers. Of particular interest to the subject of this article is its analysis because: Specifically regulate flow computers and their measurement of liquid (although not biofuel);

- Unlike other standards and regulations, it focuses on the conversion device and not on the measurement system;
- It is already structured in the form of a Brazilian regulation.

Additionally, it presents maximum permissible errors, technical sealing requirements and instructions for carrying out checks. However, it does not introduce any details of the tests to be performed (nature of the tests, minimum number of points to be collected and requirements for repeatability) or which mathematical model should be followed for the modeling of fuel fluids. This regulation also possesses

electromagnetic, climate and software requirements.

3. CONCLUSION

Each of the analyzed documents presents necessary but not sufficient elements to the composition of a full proposal regulation of flow computers for the measurement of biofuels. One possibility for solving this absence of a single text would be to write an amalgam of each of the elements presented by these standards.

The WELMEC's maximum permissible errors and tests, Inmetro's regulation N°. 499/2015 technical requirements, API's field verification instructions and specification of working standards may be used, for instance.

A better analysis of the content of these standards compared to Inmetro's regulation shows that this amalgam can be useful not only for the regulation of conversion devices in the measurement of biofuels, but also in the measurement of any other type of fluid. This fluid limitation whose flow computer regulation currently covers (only oil and natural gas) can be considered one of its greatest weaknesses and should be revised in order to comply with the provisions of the "Strategic Guidelines for Brazilian Metrology 2013-2017".

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