

# LABTQ – European Association of independent test laboratories

by **Anke Kaltenmaier, Jörg Endisch, Jean Schweitzer and Kris De Wit**

LABTQ the European Association of independent test laboratories is a non-profit organization. The collaboration between labs started already in the early 90's. Today 12 test laboratories in Europe are members. LABTQ's field of activity is focussed on appliances for heating & hot water (mainly boilers, but not excluding others) and cooking/catering. The main objectives of the association are the improvement of the accuracy of measurements and the promotion of quality testing. Therefore LABTQ is regularly organising inter-comparison tests to ensure the measurement quality of each test lab. The evaluation and discussion of the results of these inter-comparison tests (publicly available on [www.labtq.eu](http://www.labtq.eu)) and the general sharing of expertise are used to improve the reproducibility of measurements among members. Members of the association offer state-of-art and high quality testing of the above mentioned appliances. The deviation of results between laboratories in LABTQ has proven to be minimal as a result of inter-comparisons and collaborative work between members. LABTQ offers also an independent expertise for testing and measuring issues (for example in the framework of the Eco-design regulation).

## 1. INTRODUCTION

LABTQ is an association today representing 12 independent European laboratories having a broad experience in testing appliances burning gaseous, liquid or solid fuels. Its registered office is located in Brussels, Avenue Palmerton 4. The objectives of the association are:

- the enhancement of the accuracy of efficiency and emission measurements by or on behalf of its members in the field of energy using appliances
- the management, awarding, use and promotion of a qualification awarded to independent laboratories respecting an enhanced level of accuracy
- the communication of common positions to relevant third parties
- to represent the EU expertise in testing and measuring appliances in the scope of the network

LABTQ has been founded in 2008 by nine members of LABNET, a technical network of labs active in boiler testing, having meetings regularly and organizing several inter-laboratory tests since the early nineties. In the meanwhile, LABNET has been integrated in LABTQ.

A major LABTQ objective is to guarantee that its members meet stringent quality criteria for performing energy efficiency testing on boilers and water heaters by

- requiring an ISO 17025 accreditation;

- continuously organizing compulsory (for accredited laboratories) inter-laboratory tests among its members with result criteria to be fulfilled;
- pursuit of the highest possible level measurement & testing knowledge by sharing technical experiences and discussing possible solutions regarding approval and measurement techniques through periodical technical meetings.

Over the last years LABTQ members have constantly been working on improving the reproducibility of measurements by either improving the measurement equipment if possible or by clarifying the test methods by removing ambiguities.

LABTQ and its members are very active in participating in current developments like Ecodesign implementation and gas quality harmonisation. Furthermore, LABTQ has organised several workshops for stakeholders in fields of energy efficiency and emissions. A number of documents and tools have been developed through the years (Good laboratory practise for efficiency and emissions, uncertainty calculation, etc.).

With the results and experiences gained in various inter-comparison tests for different product groups LABTQ and its members are assisting in improving standards covering safety and efficiency of different energy using products.

## 2. INTER-COMPARISON TESTS

Today LABTQ's main activity is the organization of inter-comparison tests. In practise, one appliance is chosen and anonymised by the coordinator and send around to all participating laboratories together with a detailed test procedure, the instructions and an evaluation protocol.

Each participating laboratory performs the tests and sends the sample further to the next laboratory.

Before all test results are sent to the coordinator one participating laboratory exchanges the data with the coordinator at the same time to ensure fair treatment and a correct procedure.

The following methods are used to analyse the test data and to determine the standardized parameters like average, reproducibility, etc. and the validation criterion: ISO/DIS 16269-7:

Statistical interpretation of data – Part 7: Median – Estimation and confidence intervals

- ISO/IEC 17043: Conformity assessment – General requirements for proficiency testing
- ISO 13528: Statistical methods for use in proficiency testing by interlaboratory comparisons
- ILAC G13: ILAC Guidelines for the Requirements for the Competence of Providers of Proficiency Testing Schemes
- JCGM 100: Evaluation of measurement data — Guide to the expression of uncertainty in measurement

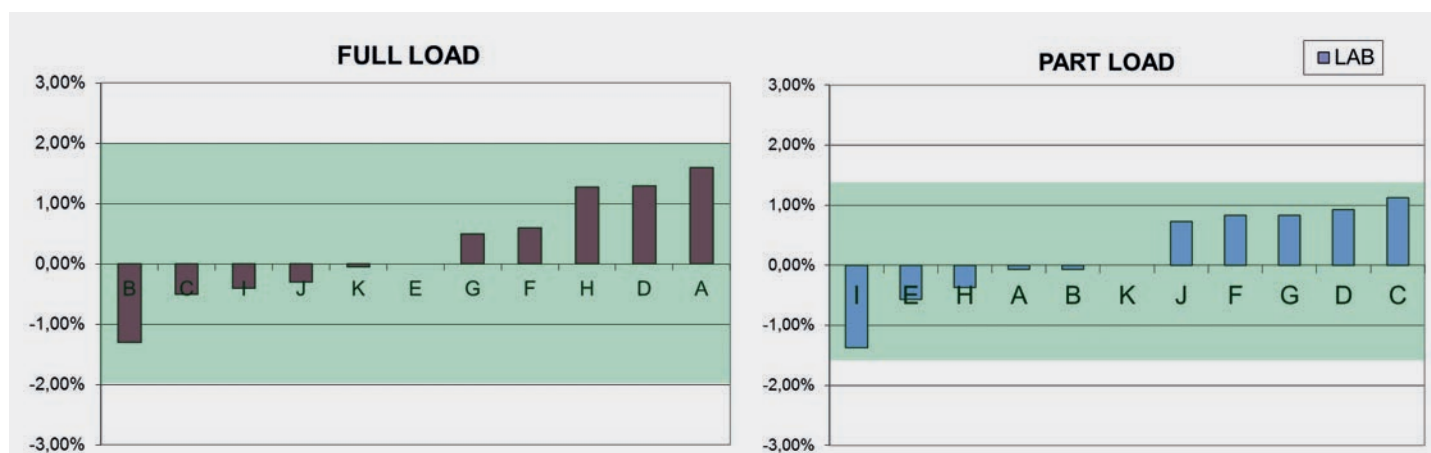
## 3. RESULTS OF INTER-COMPARISON TESTS FOR DIFFERENT PRODUCT GROUPS

Different Products and product groups have been subject to inter-comparison tests over the last years. The focus has been on full- and part load efficiency of boilers because of the Boiler Efficiency Directive 92/42/EEC and the recent implementing measures for these products in the framework of the European ErP regulation. But also other products have been tested like domestic hobs, combination appliances, water heaters and commercial cooking appliances. In the following, the inter-comparison tests for two products are presented as an example.

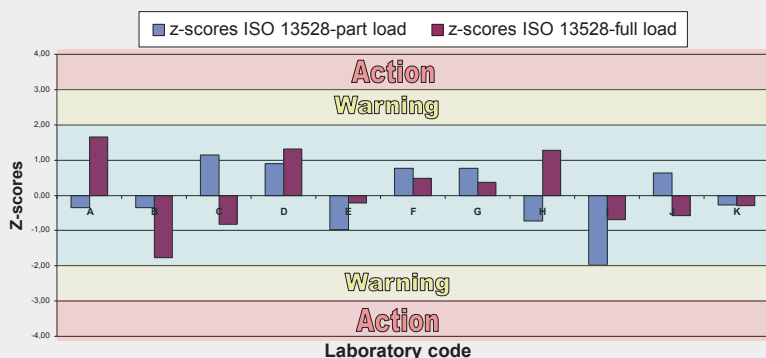
### 3.1 Inter-comparison tests on central heating boilers and combi-boilers

Inter-comparison tests for boilers included mainly measurement of full and part load efficiency besides further measurements like auxiliary energy and standby heat losses. All measurements have been performed using the test methods of EN 15502-1:2012.

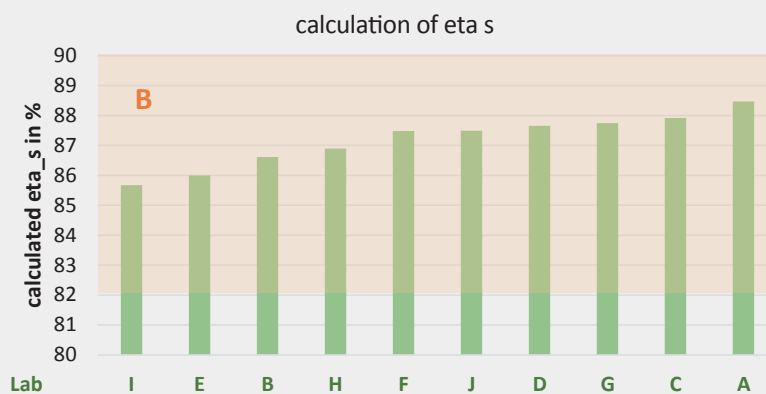
The diagrams in **Figure 1** show the results of full and part load efficiency and the evaluation according ISO/DIS 16269-7. In these tests the difference between the maximum value and the minimum value is  $\pm 1,5\%$  for full load and  $\pm 1,3\%$  for part load measurement. All participating laboratories meet the given requirements. For ISO/DIS 16269-7 evaluation LABTQ defined the criteria to pass an inter-comparison test as to reach the determined average by  $\pm 2\%$ . It shall be noted that for this specific inter-comparison test, part load measurement seems more accurate, but this was not always the case and the reproducibility difference between full and part load is not significant.



**Figure 1:** Results of inter-comparison test on boiler according evaluation method ISO/DIS 16269-7

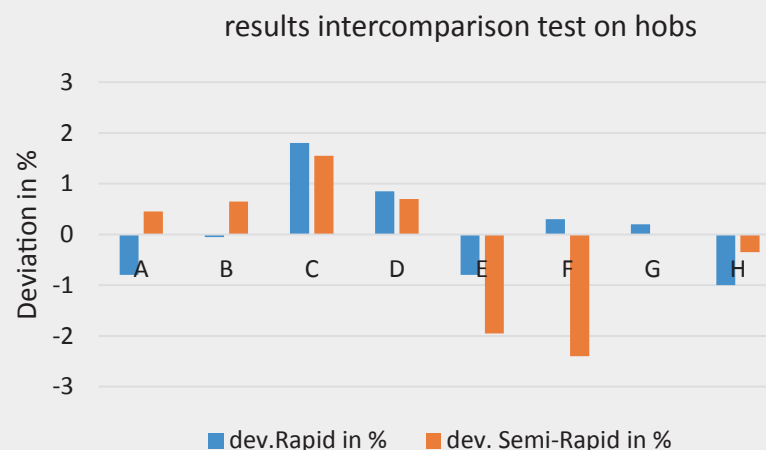


**Figure 2:** Results of inter-comparison test on boiler according evaluation method ISO 13528



**Figure 3:** Approximate results of inter-comparison test on boiler calculation of etas

(without F4 and electrical auxiliary energy in standby mode, where the measured result of values for electrical auxiliaries of standby by heat losses was not available for one lab, this value was substituted by the average of available results)



**Figure 4:** Results of inter-comparison test on burners on a domestic hob; deviations from the average determined according method ISO/DIS 16269-7.

**Figure 2** shows the evaluation according ISO 13528. This standard defines how to determine the average and criteria for “warning” and “action” signals for the calculated “z-scores” that are calculated criteria used to evaluate the individual results of each participating laboratory. In the following figure one can see that every participating laboratory achieved z-scores in the “green” range not requiring warning or action signals.

With the results for full and part load efficiency and the resulting seasonal space heating, energy efficiency ( $\eta_s$ ;  $\eta_s$ ) can be calculated (according EN 15502-1:2015). Apart from full- and part-load efficiencies the formula requests also values for auxiliary energy in full load, part load and standby mode and the standby heat losses. Due to the fact that auxiliary energy measurement during standby mode was not a mandatory part of the inter-comparison test, non-available values for electrical auxiliaries of standby by heat losses have been substituted by the average values of available voluntary measurements.

$$\eta_s = 0,85 \cdot \eta_{part,Hs} + 0,15 \cdot \eta_{full,Hs} - \sum F(i)$$

**Figure 3** shows the calculated results for seasonal space heating energy efficiency with the above mentioned limitations. In this case all participating laboratories achieved values for  $\eta_s$  above 82% and below 90% resulting in a class B label (according EU regulation 811/2013). The actual values vary only over  $\pm 2,5\%$ . The assessment is based on a simplified procedure. Of course, for a clear view on reproducibility and accuracy of Eco-design data for boilers a more precise evaluation with more tests and individual calculations needs to be performed to get the overall evaluation including the calculation methods; LABTQ intends to carry out a more detailed investigation in the near future.

### 3.2 Inter-comparison tests on domestic cooking appliances

The inter-comparison test shown here, consisted amongst others of the efficiency measurement on a domestic hob according EN 30-2-1:2005. The efficiency was determined for the big burner (rapid) and the medium burner (semi-rapid) both integrated in the hob concerned.

**Figure 4** shows the results for the determined efficiencies for the rapid and semi-rapid burner for all participating labs. Plotted is the deviation between each result and the average determined according method ISO/DIS 16269-7. The differences between the maximum and minimum obtained efficiency values are below 3% for the rapid burner and below 4% for the semi-rapid burner.

According EN 30-2-1:2015, updated, to take into account EU regulation 66/2014, the energy efficiency on

domestic hobs (EEgas hob) is calculated differently compared to the calculation method described in the previous EN 30-2-1 version. The theoretic minimum required energy for the corresponding prescribed heating (numerator) and the energy content of the consumed gas for the prescribed heating (denominator) are both first rounded to the first decimal place before dividing.

This different approach in the calculations can result in quite high differences between the values. The maximum difference for one specific result from one laboratory, calculated following the two different ways, is up to 1,6 % for rapid burner and up to 3,8% for semi-rapid burner.

Depending on the actual measured values and the influences of the rounding the overall reproducibility of a value can become worse. As an example the efficiency results for the semi-rapid burner have been recalculated in both methods. **Figure 5** shows the plotted deviations to the average value (according ISO/DIS 16269) depending on the calculation method used. In this case the difference between maximum and minimum value increases from  $\pm 2,0\%$  to  $\pm 2,8\%$

#### 4. SUMMARY

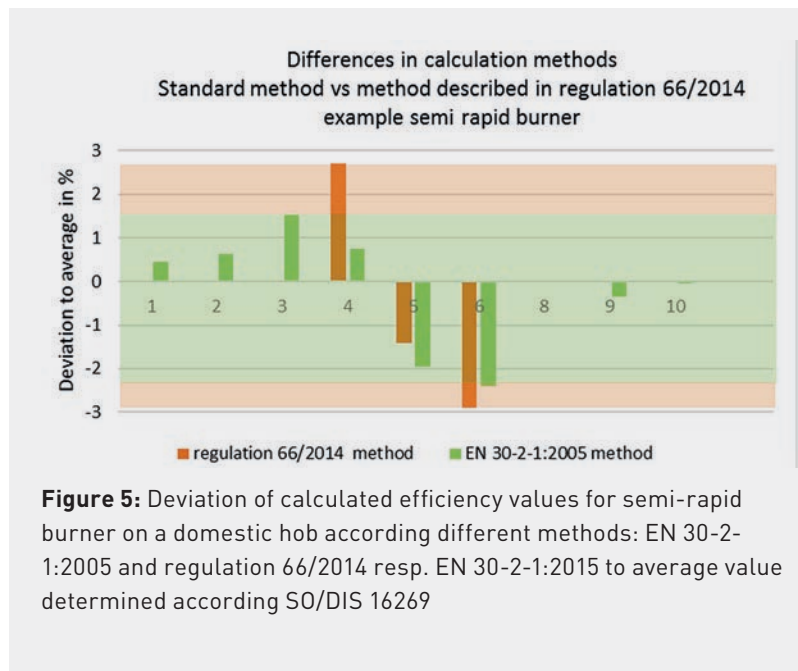
The association of European test laboratories LABTQ aims to maintain and improve the high quality of measurement and testing among the members. This requires an ISO 17025 accreditation and the participation to regular inter-laboratory tests with strict criteria to be fulfilled. The ambition of the association is to achieve excellence in measuring and testing by sharing technical experiences, solutions etc.

The results of the inter-comparison tests and the common analysis, evaluation and discussions are the main tools to improve the reproducibility of measurements. Typical actions following inter-comparison tests are for example

- Common interpretation of standards (clarifying the test methods by removing ambiguities);
- Specific adjustment of testing procedure or changing of metering equipment for laboratories not meeting requirements.

The results and experiences gained by LABTQ are useful for the elaboration of relevant regulation and the evaluation of existing schemes. From that perspective LABTQ is recognized as relevant stakeholder, bringing added value to the discussions on existing or future regulation on heating, hot water or cooking appliances.

The results of tests are also used by participants in CEN TCs in order to improve existing standards, for example bringing information on aspects of the standards that may be subject to different interpretation, etc.



**Figure 5:** Deviation of calculated efficiency values for semi-rapid burner on a domestic hob according different methods: EN 30-2-1:2005 and regulation 66/2014 resp. EN 30-2-1:2015 to average value determined according ISO/DIS 16269

The tests carried out have demonstrated that technical knowledge sharing is crucial for improvement of accuracy and reproducibility. LABTQ laboratories' work has proven to reduce deviations and it will continue pursuing this objective.

A third party certification based on independent and accurate measurement is a crucial element to make sure that minimum requirements are respected and that energy efficiency labelling informs the consumer fairly and reliably. To protect the proper functioning of the free market in this context market surveillance certainly is an essential tool, but it can only be efficient when the reproducibility of the measurements performed in the different involved laboratories has proven to be sufficient.

The members of the association can offer quality testing of appliances and the deviation of results that occurs between labs in LABTQ is minimized thanks to the inter-comparisons and collaborative work between members. As a result, for manufacturers using a LABTQ laboratory is particularly interesting and it guarantees test results that are as close as possible to the real performances of the appliances. This is absolutely vital for a fair competition on the market, but this is also vital for allowing further development and improvements on the appliances.

#### REFERENCES

- [1] ISO/DIS 16269-7: Statistical interpretation of data – Part 7: Median – Estimation and confidence intervals
- [2] ISO/IEC 17043: Conformity assessment - General requirements for proficiency testing

- [3] ISO 13528: Statistical methods for use in proficiency testing by interlaboratory comparisons
- [4] ILAC G13: ILAC Guidelines for the Requirements for the Competence of Providers of Proficiency Testing Schemes
- [5] JCGM 100: Evaluation of measurement data — Guide to the expression of uncertainty in measurement
- [6] EN 15502-1:2015: Gas-fired heating boilers - Part 1: General requirements and tests
- [7] COMMISSION REGULATION (EU) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters
- [8] COMMISSION DELEGATED REGULATION (EU) No 811/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device.
- [9] COMMISSION REGULATION (EU) No 66/2014 of 14 January 2014 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for domestic ovens, hobs and range hoods

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## THE MEMBERS OF LABTQ ARE:

APPLUS (Spain), ARGB (Belgium), CATIM (Portugal), CETIAT (France), DGC (Denmark), DVGW-EBI (Germany), KIWA Ltd. (United Kingdom), IGE (Germany), IMQ (Italia), INIG (Poland), KIWA Nederland (Netherlands), KIWA ITALIA (Italia). Further information can be found on <http://www.labtq.eu/>.

### **Some projects with the participation of LABTQ laboratories:**

“WORKSHOP Standards for the ECOdesign LOT 1 and 2: Where are we?” Proposal for co-normative work in support of the ECO design LOT1 and LOT2. Slides of the workshop available here: [www.LABTQ.EU](http://www.LABTQ.EU)

STUDY TO PREPARE A REVISION OF DIRECTIVE 92/42/EEC ON EFFICIENCY REQUIREMENTS AND ENERGY PERFORMANCE LABELS FOR NEW HOT-WATER BOILERS (TENDER NO. TREN/D1/31-2005)

GUIDELINE for the estimation of the individual uncertainties related to the full and part load efficiency measurement for boilers Contract No. SAVE 4.1031/Z/99-306

IMPROVEMENT OF INTERLABORATORY REPRODUCIBILITY FOR NO<sub>x</sub> and CO MEASUREMENTS. (Contract SMT 4 – CT 95 1606) 1996-1998

PROJECT FULL AND PART LOAD EFFICIENCY MEASUREMENTS FOR BOILERS Contract MAT 1 – CT 92-0009, 1993-1996

SAVE Z/4.1031/Z/00-005/2000 XVII SAVE The indirect determination of boilers efficiency. A more accurate and cheaper way to assess the efficiency in laboratory and on-site

BOILER SAVELEC. Characterisation and reduction of the Electrical consumption of central heating systems and components

SAVE 4.1031/Z/99-306 XVII SAVE: CREATION OF A HARMONISED and DETAILED CALCULATION METHOD FOR THE EVALUATION OF THE UNCERTAINTY OF EFFICIENCY MEASUREMENT.

GASQUAL ANSWER TO THE CALL FOR TENDER on GAS QUALITY- PHASE 1 of the Mandate M/400 Investigations on new acceptable EU limits for gas quality. Influence on the performance of new and installed gas appliances. Study Project