

## INTERCOMPARISON AQUUS-TUBE\_IMPEDANCE\_1 PROGRAM

### 1. INTRODUCTION

Before submitting of intercomparison program we consider appropriate to introduce the organization that promotes it, is the network of laboratories of acoustics, ACUSTILAB located within EUROLAB-Spain. The main objective of this organization is to promote cooperation among the members that make up the network, being promotion of inter-laboratory one of the cornerstones of our existence. We believe that as a result of these activities, it will be possible to achieve a continuous improvement of the quality of the results of the tests, in the field of acoustics and vibrations.

In the year 2010 ACUSTILAB signed a collaboration agreement with RPS-Qualitas, company dedicated to consultancy and technical assistance directed to laboratories and companies whose objective is to achieve customer satisfaction through quality systems. In that Convention ACUSTILAB - RPS-Qualitas, has as main aim activities inter-laboratory in the field of acoustics and vibrations, which are carried out with full guarantees of quality and rigour according to international standards of application. Fruit of this union we organized last year, the international ABSORPTION\_1 intercomparison character, that it had a great success, obtaining a high degree of satisfaction of the participants, to meet the required quality standards. On the other hand, we have been three years doing the intercomparison in Spain, with scopes of the acoustics of the building and the environment. We are currently finishing the exercise of intercomparison, AQUUS-2013\_3.

In order to successfully achieve the proposed objectives, it has been created the technical monitoring Committee, responsible to monitor and control the activities planned during the intercomparison. This Committee is made up of five members from ACUSTILAB and RPS-Qualitas coordinating Mr. Juan Sancho Gil and Mr. Pedro Rosario. Both organizations are responsible for all of the management, where ACUSTILAB will act as **promoter** and RPS-Qualitas as **provider** of the intercomparison, functions and specific responsibilities of each function, will be explicitly indicated in the development of this program.

## 2. OBJECTIVE

It is managing the implementation of an inter-laboratory exercise with only one scope, "*Determination of sound absorption coefficient and acoustic impedance in impedance tubes*", *part 2: Transfer-function method* " according to **UNE-EN ISO 10534-2:2002**.or **ISO 10534-2:1998**. It's an aptitude test; therefore the performance of participating laboratories will be obtained from the results obtained by all of them, during the measurements of the absorption coefficient sound in third octave bands, by applying the above standard.

## 3. SCOPE

The geographic scope of the inter-comparison is **international**, accordingly all documents, will be disseminated in Spanish and English at the same time.

Results from this proficiency tests, in addition to serving as a test of participants, will also serve to improve the knowledge of the State of art in the application of this method of trial, regarding the data's precision.

We are plans to develop this program of inter-comparison for the year 2013, concluding with the delivery of results to participants at the end of December of that year.

## 4. PROCEDURE

The test shall be conducted using the methodology given in **ISO 10354**. The supplier will provide a general protocol of test participants to improve the overall accuracy of the exercise. The promoter shall inform participants capacity for conducting trials in adequate conditions.

### 4.1 TESTING

#### 4.1.1 Place of execution and prerequisites

Each institution participating in the inter-comparison, will develop tests in their own facilities, specifically with their **tube or tubes of impedance**.

The interested laboratories for participating must inform the Coordinator, on the technical capacities available to address tests, by properly completing the **tab of table 1 of annex 1**, of this intercomparison programme.

#### 4.1.2 Management of the test sample

ACUSTILAB will manage the acquisition, storage and distribution of the sample at each participating laboratory. Be sent to each participant laboratory one sufficient quantity of material to perform the test, leaving each participant material excess to other quality control tests.

Each laboratory will verify that the received material is specified, which has come under appropriate conditions and the amount of sample received is sufficient to perform the tests. This will inform the Coordinator of the inter-comparison as soon as possible.

Will be sent to all participants **two types of samples:**

**Sample test A:** two sheets size A3, estimates 50 mm thick rock wool panel.  
Manufacturer: ROCKWOOL, model 231.652.

**Sample test B:** two sheet of A3 size of 25 mm thick mineral wool CLIMAVER NET.  
Manufacturer: SAINT GOBAIN ISOVER Spain glassware.

Two types of materials manufacturers guarantee that supplies sent to ACUSTILAB belong to the same production batch.

#### 4.1.3 Measures

By involving a large number of laboratories, scattered in the European area, the campaign of testing, is scheduled so that all laboratories perform **the tests between September 27 and October 23, 2013.**

We have planned for the exercise, so that all the participants **sent the results of the tests, before November 5, 2103,** to the provider of the intercomparison.

#### 4.1.4 Test Procedure

As indicated in the scope, this exercise will cover the test which consists of measuring the sound absorption coefficient by impedance, according to the **UNE-EN ISO standard tube 10534-2:2002.**

The values of **absorption coefficient of each test, obtained for discrete frequencies** from the frequency responses of the system used in the measurement, which will be sent to the provider of the intercomparison in sheet 1 of the supplied Excel file. Additionally, the values of coefficient of absorption at discrete frequencies **will be converted using averaged** to values of the coefficient of absorption in third octave. The promoter will send participants the Protocol will continue to carry out that transformation. In sheet 2 of the supplied Excel file including the values of the absorption coefficient in third octave, in the range from 100 Hz to 5 kHz both included.

## 4.2 TESTS EXECUTION. SPECIFIC TECHNICAL REQUIREMENTS

The full test includes sample cutting process on the inside of the tube. It should be especially careful in the phase of preparation of samples, avoiding its deterioration due to an inappropriate cut.

Each laboratory will prepare 4 samples of each type, which will be used to measure the absorption coefficient in each of the 4 trials to be performed by each type of material. Samples made and used in the measurements will be photographed and saved for possible repetitions. Each laboratory will send the provider a photograph of each of the samples used in the measurements.

Once placed the sample of material on the inside of the tube with the appropriate care, each laboratory will wait at least 15 minutes before starting the measurement of the absorption coefficient, in this way the material adapts to environmental conditions of inside the tube.

It is advisable to **be especially careful** in the assembly of the sample inside the impedance tube, in order to avoid that it change its intrinsic properties.

You must measure and record the values of **temperature, relative humidity of air and atmospheric pressure** at the beginning and end of the execution of each test. The variation of temperature during the test must be less than 1 K.

In addition, each laboratory must:

- Use **your tube or impedance tubes, your samples, your measurement system and auxiliary equipment, their record sheets**, the relevant hearing protectors, etc. And will operate as it does in your usual measures.
- **Each participant must perform 4 complete tests** including the elaboration of the test samples. Four tests of each type of sample is recommended in the working day.
- Other operational aspects that are considered necessary will be indicated in the "basic test execution Protocol"

To perform the tests follow the procedure that usually apply laboratories, both in terms of the personnel responsible for performing them, as to the measurement equipment used, and always observing the above mentioned requirements and other required by the standard.

#### 4.2.1 Preinscription and transmission of the results

In the pre-registration phase, laboratories interested in participating, must be completed formulated questions on the **annex 1 of this intercomparison program**. Each laboratory **will inform the promoter of the intercomparison** of the following issues:

- Method of measurement applied, tube or tubes available and other details relevant to the measurement system.
- Frequency range, which covers measurement system employee, calculated as specified by EN ISO 10534-2:2002, paragraph 4.
- In the case of used two tubes, the participant shall inform the Coordinator of how determined results in a frequency range where two tubes are operating, according to the requirements set out in paragraph 4 of the standard.
- Absorption coefficient of the system received reference sample, and that is used for the correction of phase between channels of the measuring system, or other settings. The absorption coefficient of the reference sample data will be delivered in the discrete frequencies of the measuring system.

Each interested in participating laboratory will send the duly completed **questionnaire in annex 1** to the promoter of the intercomparison, to the following e-mail address: [gerente@acustilab.es](mailto:gerente@acustilab.es). The promoter shall inform each lab within a week, on the suitability of their participation. If so, the relevant laboratory shall register with the greatest possible urgency, as **maximum 7 days after receiving the welcome**.

Formalized registration, when evidence of having made the appropriate payment, the promoter will be sent to each participant laboratory "**sheets of two types of material**" that will be used to prepare samples for testing, "**the basic execution Protocol**" and "**the file data and results**". The deadline for Coordinator supply the test material and the documents cited to each participant, it is **September 27, 2013**.

Each participant must complete properly the "**data and results file**" once carried out tests. This file duly completed, shall be sent to the provider of the intercomparison, to the e-mail address: [rps@rpsqualitas.es](mailto:rps@rpsqualitas.es), by **November 5, 2013**.

When not received data from a participant in dates, **RPS-Qualitas will immediately get in touch with that participant**, to clarify the causes that have prevented the reception of their results, and find out if a problem occurred in transmission electronic information, not attributable to the laboratory.

#### 4.2.2 Exclusions

They are not accepted:

- Data and results sent out the deadline
- Data or results received in different from the pre-set formats.
- Data or incomplete received results.

#### 4.2.3 Correction of results

Corrections to data and/or results sent will only be accepted **if requested in writing** and always **within the time-limit for receipt specified** for each participating laboratory.

#### 4.2.4 Contents of the registration form

The file that is used for transmission of data and results must be obligatorily filled out and sent in Excel format, with the following content:

- Identification of the laboratory
- Identification of the person responsible for the tests
- Identification of the equipment used
- Results of the measures and their units
- Estimated uncertainty of measurements, (optional)
- Data samples, photos
- Details of the measures
- The environmental conditions of each test data
- Observations

### 4.3 DELIVERY OF RESULTS

The results of the intercomparison will be sent to participating laboratories by the end of the month **December 2013**.

### 4.4 ENTITIES INVOLVED IN THE MANAGEMENT

- Promoter ACUSTILAB, belongs to EUROLAB-Spain
- Entity provider RPS-Qualitas
- Participants in the **Technical Commission**:
  - Three members of ACUSTILAB
  - Two members of RPS-Qualitas
  - ACUSTILAB Manager, as general coordinator.
  - Manager of RPS-Qualitas, international management.
- Statistical treatment RPS-QUALITAS
- **Technical Committee** final report.
- Participating laboratories: all those who register.

### 4.5 SCHEDULE OF MAIN ACTIVITIES

The content of the schedule is defined in **table 2** of this document.

## 4.6 CONFIDENTIALITY

**RPS-Qualitas**, entity that will manage the data and results of the participants, will assign an alphanumeric secret code each participating entity, that will accompany them throughout the year until the final report. This single identification code shall be traceable for RPS-Qualitas with each participating laboratory.

To make public the list of the participating laboratories, should not have opposition explicit by writing to the Commission, by any of the participants.

## 4.7 QUALITY ASSURANCE

**ACUSTILAB and RPS-Qualitas** are committed to the proper execution of the services object of this programme, in accordance with the requirements in the technical note NT-03 Ver\_5 of ENAC, the ENAC Guide G - 14 as well as the application of the principles of good practice accepted by organizations that provide such services. In particular, apply the requirements laid down in the standard UNE - EN ISO 17043:2010 that regulates the intercomparison tests.

To achieve adequate standards of quality of the intercomparison, will be carried out, by the Organization, various controls to ensure both the conditions of the tests, as the fulfillment of the regulations applicable to the scope which covers this intercomparison. To do this, the following actions have been defined:

- The distribution of the sample will be done from ACUSTILAB, by sending to each participant laboratory, the amount of enough material and immediate, once confirmed participation.
- At the beginning, before the period of testing, **homogeneity tests** will be run. A laboratory accredited ISO 17025 by ENAC will perform these tests.
- At the end of the testing period, the same laboratory repeated testss on the same samples, to determine the **stability of the sample** during the time of intercomparison.
- The Technical Committee will carry out a comprehensive analysis of the results of the intercomparison, and shall inform participating laboratories wishing to do so through a **final meeting with the participants**, to be held in the first months of the year 2014.

## 4.8 STATISTICAL ANALYSIS

### 4.8.1 Standards Reference

- ISO 5725-2
- ISO 17043:2010
- ISO 13528:2005

#### 4.8.2 Statistics Evaluation

The distribution function showing the data received by the participants, will apply in each case with the rules indicated in the previous point. Therefore, the proposed approach may be the classic statistical treatment (which includes testing of discrepant values) or the application of methods of robust data analysis (which minimize the contribution of the anomalous values through appropriate robust algorithms).

- **Assigned or reference value.**

It is obtained from the results of all participants, calculated as the value of consensus among the results of all participants, either after excluding discrepant values or the calculation of the robust average.

This value will be used as reference value for each test, both in the results expressed in third octave, as in the case of global values.

In addition, will be included an estimate of the uncertainty of the value assigned, determined depending on the statistical technique used.

- **Standard deviation of the intercomparison exercise.**

Usually be determined from the results of the participants from the calculation of the standard deviation of reproducibility (SR), although according to the distribution of the results you can also calculate using methods of analysis used robust estimators conforming to ISO 13528.

Without prejudice to the estimate of the repeatability and reproducibility of exercise, exceptionally requirements externally, either from normative references or other technical criteria that assess the accuracy may be used.

#### 4.8.3 Assessment of the performance of participants

The evaluation of the results of the participants is performed starting from the values listed above or other possible options, calculating the Z-score index which allows assessing the performance of each laboratory.



#### 4.8.4 Content of the FINAL report of each participant

It will be provided to each participant a comprehensive report to the extent in which it has participated effectively, with the following content:

- Table with the results of the participating laboratories
- Graphic representation of the measurement of the results of laboratories
- Value assigned to each parameter and scope
- Uncertainty of the reference value and acceptable range depending on the reproducibility of the measurements
- Graphical representation of the normalized values of the index Z-score of each laboratory for each parameter, with the possibility of including combined indices of performance.

#### 4.8.5 Content of the Global Final Report

It shall draw up a comprehensive Final report with the overall results of the exercise, which will initially be provided to the participants and if not received indication against any of them within a specified period, the public dissemination of the same will take place.

### 5 SUGGESTIONS AND CLAIMS

In accordance with the policy of ACUSTILAB and RPS-Qualitas, we always perform our activities under the prism of continuous improvement of the quality, so we are open to suggestions from the participating entities.

On the other hand, the Organization undertakes to pay necessary attention to any dissatisfaction or complaints, which will be analyzed and answered within a maximum period of one month after the reception.

### 6 COST

#### 6.1 COVERED ACTIVITIES

- Cost of the sample and storage and distribution.
- Administrative management of the project.
- Use of Spanish and English in all documents and communications with the participants
- Measures of homogeneity and stability of the samples.
- Attention to the participating laboratories.
- Statistical analysis of the data and results.
- Preparation of the final report.

## 6.2 PRICE LISTS

The cost per participant is indicated in table 1. The amounts indicated do not include VAT, so the total cost have to add 21% VAT.

	PRICE (VAT NOT INCLUDED)
Measurement parameter Test standard	General fee
UNE-EN ISO 10534-2:2002 "Determination of the sound absorption coefficient and acoustic impedance in impedance tubes".	590

*Table 1: table of prices (VAT not included). It will be applied to the final price 21% VAT.*

## 7. References

**UNE - EN ISO 10534-2:2002** "Determination of the coefficient of sound absorption and acoustic impedance in tubes of impedance, part 2: method of transfer function"

**ISO 5725-2:2002** Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method

**UNE 82009-2:1999** "accuracy (accuracy and precision) of measurement methods and results. Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method

**ISO 13528:2005** "Statistical methods for use in proficiency testing by interlaboratory comparisons".

## REGISTRATION FORM

IDENTIFICATION OF PARTICIPANTS LABS			
<b>Name of the participant</b>			
<b>Responsible for</b>		<b>Phone</b>	
<b>CIF</b>			
<b>Address</b>		<b>C.P.</b>	
<b>Locality</b>		<b>Province</b>	
<b>Phone</b>		<b>E-mail</b>	

**Mark with an X the scope at which you want to participate.**

REQUESTED SCOPE	
<b>UNE-EN ISO 10534-2:2002</b> "Determination of the coefficient of sound absorption and acoustic impedance in impedance tubes"	

**Note: The price is calculated according to the table 1.**

CONTACT INFORMATION FOR ADMINISTRATIVE MATTERS RELATING TO BILLING			
EUROLAB-Spain	Calle Alenza, nº 1, 28003 Madrid	<b>CIF</b>	<b>G-60651015</b>
Contact person	Elena García Hernanz	Tel. and Fax	91 3990174
Email	<b>secretaria.administrativa@eurolab.org.es</b>		
Transfer to CCC No.	0081 0098 70 0001242230		
Ref: transfer	<b>Intercomparison AQU-S-TUBE_IMPEDANCE_1</b>		

### Registration conditions:

- Limited places to meet the timetable laid down in the schedule.
- Entries must be made in writing by email, simply by filling in the spaces of this registration form, and enclosing proof of payment.
- The intercomparison program registration is not effective until it does not carry out the indicated current account income.
- For reasons of logistics, is appreciated is to make the registration **before September 17, 2013**, being required to be registered to receive the sample for the testing and the Protocol.
- ACUSTILAB reserves the right to cancel the realization, where the number of participants is insufficient, in which case it shall refund of all amounts paid by the participants.
- Amounts will only be refunded to the lab which has not failed to carry out the tests, for reasons attributable to the Organization of the exercise.

**TABLE 1: TIMELINE: AQUS-TUBE-IMPEDANCE\_1**

Actions	Responsible	July			August				September				October				November				December				January			
		2nd	3rd	4th	1st	2nd	3rd	4th	2nd	3rd	4th	1st	2nd	3rd	4th	2nd	3rd	4th	1st	2nd	3rd	4th	2nd	3rd	4th	1st	2nd	3rd
Homogeneity tests.	Technical Commission		█	█																								
Sample management	Technical Commission	█	█	█	█	█	█	█																				
Samples sending	Commission Technique								█	█	█	█																
Tests	Participants												█	█	█	█												
Statistics	RPS-Qualitas																	█	█	█	█							
Analysis of results	Technical Commission																				█	█	█	█				
Report to laboratories	RPS-Qualitas / Commission																					█	█	█				
Final Meeting	RPS - Qualitas / Commission																									█	█	█

Table 1: schedule of implementation of main activities

**Madrid 27 June 2013**