QUALITY ASSURANCE IN PASLINK TESTS

E. Maldonado and M. Borges

Department of Mechanical Engineering, University of Porto
R. Dr. Roberto Frias, 4200-465 Porto, Portugal

ABSTRACT

The operation of an outdoor test site requires very substantial efforts with respect to investments, maintenance, calibration and training staff. The existing documents dealing with quality procedures in principle guarantee that a good quality level is achieved at all test sites. This paper describes the existing quality manuals and the software tool PASLINKIT developed in the scope of IQ-TEST Thematic Network to make all this pertinent quality documents more practicable and feasible. Rather than trying to simplify the procedures that have been in place, which were considered as the minimum acceptable for ensuring quality testing, PASLINKIT is a user-friendly tool to manage quality control at test sites.

KEYWORDS

Quality, Outdoor tests, Building components

INTRODUCTION

Quality assurance is a key element in every testing procedure. Clients need full confidence in the results that are obtained. Certification on the basis of ISO 9000 series standards or the more recent ISO 17025 has become the most acceptable means to ensure quality in testing. The two key points for quality assurance are, therefore:

➢ Detailed written procedures describing every aspect of the testing, including data analysis
➢ Use of calibrated equipment, duly documented in terms of link to a primary standard
➢ Use of qualified staff
➢ Carry out inter-comparison tests

Tests carried out at PASSLINK test sites must offer this level of quality. To do so, an internal certification scheme, described in the next pages, has been created to ensure overall quality and equivalency of tests in any of the PASLINK member laboratories.

QUALITY MANUALS

The Quality manuals describe procedures and record every event and action that occurs at any test site, during the preparation and execution of tests, as well as in between maintenance and upgrading. The information has been organised into four Manuals covering specific areas of the laboratories:

Apparatus Manual

All the equipment used at the test site is uniquely identified, making reference to the manufacturer's documentation for use and maintenance. This manual is site specific. Each test site has its own Apparatus Manual and is responsible for the regular updating.

Operations Manual

For all the equipment developed specifically for these laboratories, e.g., the test cell, its heating and cooling unit, the tracer gas equipment for ventilation rate measurement, etc., operating manuals have been produced describing the characteristics and the construction details, as well as instructions for the proper operation of the devices. This manual also allows other laboratories interested in this type of testing to know how to meet the same performance requirements.

Test Procedures Manual

This manual describes the measurement and data analysis procedures for the determination of the thermal and solar characteristics of building components in outdoor PASSYS test cells. The measurement procedures describe the heating and cooling control strategy for the test cell and the required equipment, instrumentation, preparation and reporting tests carried out under dynamic indoor and outdoor conditions.

The data analysis procedures describe the principles of parameter identification and the steps to be followed in the preparation, execution and evaluation of the parameter identification process. It also contains an extensive example of the data analysis.

Calibration Manual

The Calibration Manual provides information on the calibration of all sensors, as well as the data acquisition system with its software. It sets out calibration procedures and required maximum intervals for periodic calibration for all types of sensors.

THE PASLINKIT SOFTWARE

To fully implement the quality requirements in terms of keeping up the manuals with up to date information is a time-consuming activity. To facilitate the implementation of the quality system at each PASLINK laboratory, and to easily provide clear evidence to quality inspectors, all the manuals have been organized in the software tool PASLINKIT, where all the information can be easily stored and looked up at any time. It includes the possibility for easy updating and producing all the important information about the status of compliance of a particular team with the quality requirements, namely about the valid calibration of every instrument or sensor relating to any test. This tool was written in Visual Basic and it has the following main features:

- A <u>data-base with all the sensors at each of the test cells</u> in each test site. Updating this data-base is easily done by removing old sensors and adding new ones via menu. A simple click on a test cell will list all the corresponding sensors, as shown in Figure 1.
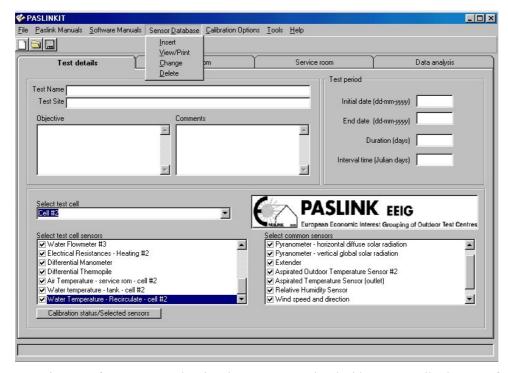
Figure 1: Main page of PASLINKIT showing the sensors associated with one test cell. The menu for updating sensors is also shown.

- Indication of the calibration status of each sensor and equipment. The data-base includes the date when the last calibration was performed, and the required deadline for recalibration. PASLINKIT then computes if the calibration is still valid or not, and displays the status by sensor with a color code: green if the calibration is still valid, and red if a recalibration is needed. The user can also specify a warning period (e.g., 60 days) to issue an alert for sensors that will need recalibration within that period. These sensors are then displayed in orange. Figure 2 shows an example of such a listing for a particular test cell. Yellow represents sensors that do not require calibration.
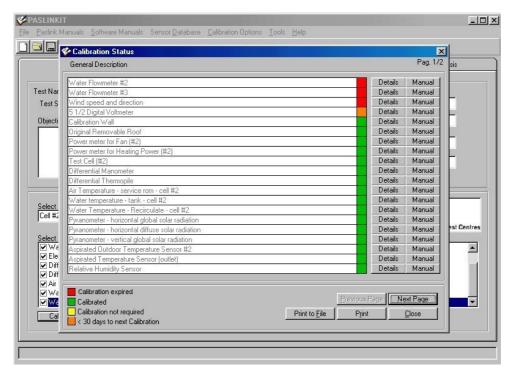

Figure 2: Status of calibration listing in PASLINKIT, ordered by easy to read color codes.

- Easy access, by menu, to all the <u>four Quality Manuals in pdf format</u>: Apparatus Manual, Operations Manual, Calibrations Manual and Test Procedures. New versions of the Manuals can be added or old ones removed using the menu.
A full search is available to locate where a certain word appears in the text of any of the manuals in the database, making it easy for anyone to locate where a certain topic is addressed.

- <u>Sensor calibrations</u> are input in detail using a linked EXCEL spreadsheet. Old calibrations are kept on file, but the tool recognises the latest one for the updating of the calibration status of each sensor.

- Detailed recording of <u>procedures, sensors and respective calibration status, data files and analysis of results for each test</u>. This information is organized into 4 pages: Test details (see Figure 1), Test room and Service Room strategy (see Figure 3), and Data Analysis and Results (see Figure 4). Data files names and locations are recorded for future use, as well as analysis tools used.
Each test can be recorded with a specific name and kept in the test site data base and viewed later whenever necessary.
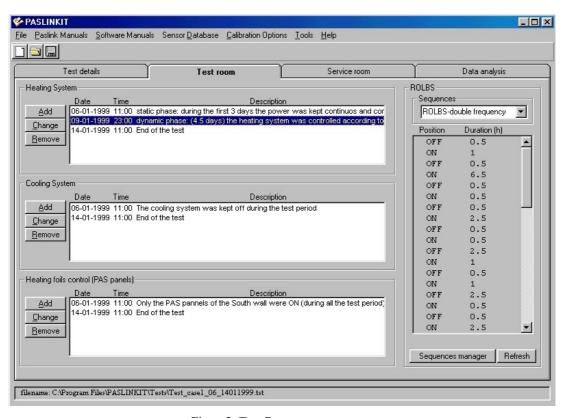

Figure3: Test Room strategy page.

Further facilities of PASLINKIT include:

- Software Manuals are available in pdf format (CTLSM, LORD. MRQT, PASFIL). New manuals can be added and old ones removed using a menu command.
- Periodic backups of the database can be done for security reasons.
- Easy access, by button, to all the calibration manuals in pdf format.

- All the information can be printed using simple commands for hard-copy versions of the Manuals, for record keeping and for meeting requirements of formal ISO 9000 or 17025 Quality procedures.
- A password protection to prevent unauthorized or accidental changes of information.
- A search function for all pdf documents by keyword.
- A detailed description of the dynamic test sequences.
- Information about the date of the last update of PASLINKIT.
- Automatic connection between the date of any calibration sheet and the update status.
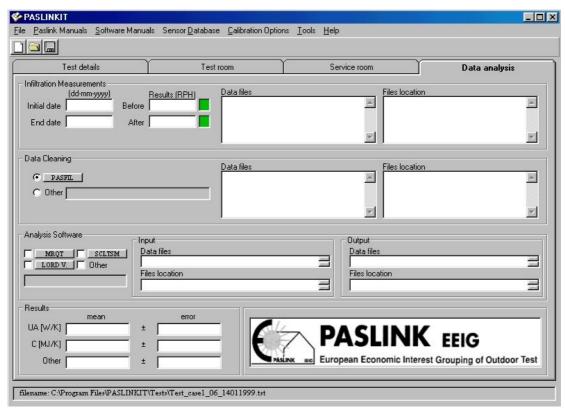

Figure 4: Data Analysis and Results page.

STAFF QUALITY AND INTER-COMPARISON EXERCISES

Data collection and quality is but one of the fundamental components of quality assurance. Data analysis, especially when dynamic responses must be analyzed by more or less complex statistical procedures, involving heat transfer models that call for judgement on the part of the staff, is equally fundamental in importance. ISO quality standards require proof that those collecting and analyzing data must have the needed qualifications and training. PASLINK thus organizes regular training sessions and inter-comparison exercises where individual performances are analyzed and proficiency improved in the use of the tools at their disposal. The results of one such inter-comparison exercise are described elsewhere (Paul Baker, 2002).

CONCLUSIONS

PASLINKIT was developed to ensure a practical, pragmatic tool to allow the implementation of common quality procedures at all the test sites in an affordable and not time-consuming way. It covers all aspects of the quality certification, namely testing procedures, calibration, data gathering, cleaning and analysis, interpretation of test results, as well as maintenance of test infrastructure in all test sites. It has been easily integrated into formal quality certification schemes obeying ISO 9000 in the PASLINK laboratories that have taken that option, showing that it satisfies all its objectives.

PASLINKIT is also a powerful tool as it offers, under a single user-friendly application, all the needed information for test site managers and for quality inspectors:
- a set of updated quality procedures for operation of the test sites and for product performance evaluation;
- the complete series of quality manuals;
- the most up-to-date information about the calibration status of each and every sensor in the test site, as well as a calendar for needed recalibrations;
- a list of data files (name and location) for each test.

PASLINK has also implemented a regular plan for common experiments and data analysis exercises to satisfy the other fundamental component of the quality assurance schemes based on ISO 9000 and its more modern versions.

Therefore, PASLINK has achieved common methodologies that ensure that every internally accredited test site is capable of producing data with good quality and to analyse them to reach the correct thermal performance indicators of building components under testing.

REFERENCES

B.Saxhof. (1995). *Paslink Calibration Manual*, Thermal Insulation Laboratory Technical University of Denmark, PASLINK.

H.A.L.van Dijk, F. Tellez. (1995). *Measurement and Data Analysis Procedures*, TNO Building and Construction Research, CIEMAT, COMPASS.

Paul Baker (2002). *IQ-Test - Improving quality in testing and evaluation of thermal and solar characteristics of building components*. EPIC 2002, Lyon.