SANS 10400: The application of the National Building Regulations:

Protocol for the Certification of Energy Simulation Software: Second edition, September 2011

Introduction

The need for reducing greenhouse gas emissions associated with non-renewable energy consumption and resulting global warming has been internationally recognised.

The September 2011 amendment to the National Building Regulations introduces Part X: *Sustainability* which comprises Part XA: *Energy usage in building*s. Part XA introduces requirements for energy usage in buildings having the following occupancies: A1, A2, A3, A4, C1, C2, E1, E2, E3, E4, F1, F2, F3, G1, H1, H2, H3, H4 and H5, in accordance with the classifications of regulation A20, excluding garage and storage areas contained within such occupancies. These requirements are intended to ensure the efficient use of energy within buildings and that building envelopes are effective in reducing energy required to control their internal environments.

The requirements of these regulations shall be deemed to be satisfied when buildings are designed and constructed in accordance with SANS 10400-X: 2011 (Part XA: Energy usage in buildings).

SANS 10400-X: 2011, Part XA, Clauses 4.2.1 a) and c) require building energy simulation software for calculating energy requirements. Given the variability of output possible from different software packages it has been deemed appropriate that software used be fit-for-purpose. As such, one of the requirements of Part XA is that software be assessed by the Board of Agrément South Africa and, if found suitable, certified as fit for thermal modelling or calculation purposes.

The assessment of such software by Agrément South Africa will be carried out in terms of a protocol based on recommendations made by CSIR Built Environment, which was commissioned for this purpose.

Energy usage within different buildings and occupancies varies in both quantity and complexity. Large buildings with HVAC equipment require technically demanding software in comparison to small domestic buildings. As such, two levels of

building simulation software are advocated, as follows:

- the first, applicable to the assessment of all buildings including large commercial and institutional buildings

- the second, applicable to the assessment of small domestic buildings only.

An important element of Agrément certification is that related to quality assurance, technical support and training. It will therefore be a requirement of certification that the applicant have in place and maintain:

- an acceptable and documented quality management system, based on the requirements of ISO 9001 as appropriate for the applicant's organization, covering software development, testing and distribution,

- a technical support capability, and

- the ability to offer training on the use of the software, when required.

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ISO 9001: Quality management systems - Requirements

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General Requirements for both levels of software

The following will need to be supplied by Applicants:

- details of the applicant and the name of the software to be assessed, a copy of the software and all supporting documentation/manuals

- details of the software developer with contact details, if not the applicant,

- the applicant's relationship with the software as well as between the applicant and the software developer, if applicable

- the status of the end-supplier, where applicable: local licensed agent or sole supplier

- description of the software and if it is applicable for the assessment of all buildings including large commercial and institutional buildings or small domestic buildings only

- technical information covering the methods of assessment used which must be in accordance with the principles of thermodynamics and fluid mechanics. Methods used must be documented and available for inspection, if requested

- sources of reference data on the thermal properties of materials and insulation which must be applicable for use in South Africa and the ability to edit or add new materials must be included

- a brief summary of the software developer's and/or the applicant's experience with respect to software development, support and training

- records of appropriate testing and validation carried out at the time of software creation, updating and quality assurance, if requested

Specific Requirements for the Certification of Energy Simulation Software for the Modelling of all Buildings Including Large Commercial and Institutional Buildings

> *ABCB Protocol for Building Energy Analysis Software*

> ASHRAE 90.1: *Energy standard for low-rise residential buildings*

The following protocol would cover all software contemplated in Part XA of the proposed amendment to the National Building Regulations and SANS 10400: Part XA for all building types and sizes. This protocol is primarily based on international best practice, ASHRAE 90.1 as well as the *ABCB Protocol.*

The simulation program shall be a computer-based program for the analysis of energy consumption in buildings. The simulation program shall have the ability to explicitly model the following:

- 8 760 hours per year based on hourly values of climatic data

- Hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat set-points (separate for cooling and heating, with a "dead zone" in-between), and HVAC system operation, defined separately for each day of the week and holidays

- The three dimensionality of all elements of the building including tilt angles and building orientation

- Shading effects, on both windows and walls, from the elements of the façade, wings of the building, and adjacent buildings

- Solar absorptance and emissivity of surfaces

- Thermal mass effects

- Part-load performance of mechanical equipment, with simulation based on user-entered seasonal equipment efficiency values being the minimum acceptable method

Aspects of the building that may be modelled by adding in pre-determined data or through direct modelling are:

- Vertical transport loads

- Supply hot water loads

Additionally the simulation program must:

- Be commercially or universally available

- Be capable of computing the annual energy consumption of a building in accordance with SANS 10400 Part XA

ASHRAE Standard 140-2001
Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs

- Be tested in accordance with ASHRAE Standard 140-2001 and the results shall be furnished by the software provider

Furthermore, where results from the testing protocol ASHRAE 140-2001 are not comparable with other similar software then the software provider is required to provide an explanation for the discrepancies.

Specific Requirements for the Certification of Energy Simulation Software for the Modelling of Small Domestic Buildings

The following recommended requirements are primarily based on international best practise, ABCB Protocol for House Energy Rating Software and the Procedure for Accrediting Software Under the Nationwide House Energy Rating Scheme.

Compliance with this protocol certifies the Simulation Program to be used in accordance with Part XA of SANS 10400 and for building classes H2, H3, H4 and government subsidy homes.

Details of the following elements, including the materials and their properties, must be addressed:

- Thermal mass effects
- Floor and floor enclosure assembly
- The three dimensionality of all wall roof and ceiling elements of the building including tilt angles and building orientation
- Solar absorptance and emissivity of surfaces

Additionally the simulation program shall:

- Be tested in accordance with and pass Home Energy Rating System Building Energy Simulation Test (HERS BESTEST), 1995;

OR

- Be tested in accordance with ASHRAE Standard 140-2001 Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs.

When a software package does not meet all minimal requirements, while still performing well in relation to ASHRAE140, it can still be certified provided that the software provider provides documentation discussing the non-compliance with the relevant minimal requirements.

HERS BESTEST, 1995: Home Energy Rating System Building Energy Simulation Test