PROTOCOL

FOR

HOUSE ENERGY

RATING SOFTWARE

Version 2005.1

AUSTRALIAN BUILDING CODES BOARD

MAY 2005

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Foreword

The Australian Building Codes Board (ABCB), a joint initiative of all levels of Australian Government in cooperation with the building industry, is responsible for the provisions of the Building Code of Australia (BCA) including those for energy efficiency.

On 1 January 2003, minimum energy efficiency measures for houses were introduced into BCA Volume Two. The measures include a Verification Method that allows suitable house energy rating software, based on climate regions, to be used to demonstrate compliance with BCA Performance Requirement P2.6.1.

On 1 May 2005, minimum energy efficiency measures for other Classes of residential buildings were introduced into BCA Volume One. The measures include a Verification Method that allows suitable house energy rating software, based on climate regions, to be used to demonstrate compliance with BCA Performance Requirement JP1.

The Protocol now contains a testing regime for simulation software but does not yet contain a testing regime for correlation software. It is intended to develop this during 2005. In the meantime, correlation software manufacturers will need to provide suitable evidence showing a reasonable correlation with the results from simulation software.

Need for a Protocol

The suitability of the software will be dependent on it being of an appropriate standard and that it provides results that are repeatable. In order to ensure that these objectives are met, and that results are consistent using different software, a Protocol for House Energy Rating Software is considered necessary.

Background

Energy rating software has been available for some time under the Nationwide House Energy Rating Scheme, which provides a standardised approach for energy rating of houses throughout Australia. Although the Scheme is not mandated, its 'Star Rating' system is now referred to in the BCA along with explanatory information referring to particular versions of suitable software. The BCA is recognised as the minimum technical standard for the construction of buildings in all States and Territories.

The Scheme was developed by the State and Territory energy agencies and the Australian Government, in conjunction with the CSIRO. It is administered by the Energy Efficiency Working Group (E2WG), on behalf of the Ministerial Council on Energy, and managed by the Australian Greenhouse Office (AGO).

The energy loads and the associated star bands specified in this Protocol were developed for, and set by, the E2WG.

The ABCB, in conjunction with the State and Territory building control Administrations, maintains and develops the BCA which, in turn, is given legal status by the State and Territory Building Acts and Regulations. Any material referenced in the BCA needs to be clearly identified and described as it also has legal status under the Building Acts and Regulations. This Protocol has been prepared to describe the software acceptable to demonstrate compliance with the BCA Performance Requirement and to provide a process for demonstrating the acceptability of new software and revisions to existing software.

Aims of Protocol

The primary goal of the Protocol is to provide a legal basis for allowing the use of house energy rating software to demonstrate compliance with BCA Performance Requirements JP1 and P2.6.1 via the Verification Method route.

A further aim of the Protocol is that it be neutral to all software in accordance with National Competition Policy.

The Protocol is not intended to be used as a driver for implementing the Nationwide House Energy Rating Scheme (a responsibility of the energy agencies), or for changing the Scheme. The energy loads and associated star ratings in this Protocol provide a set benchmark for determining compliance with the BCA.

However, the ABCB acknowledges that the Protocol, including the energy star rating figures, may be subject to revision from time to time as the Scheme is improved and developed. The Protocol may, therefore, be amended as necessary.

Note that at the time of publishing this revision, the Nationwide House Energy Rating Scheme is undergoing significant review which will probably have an impact on the energy star rating figures. When that work is completed and accepted by building control Administrations, changes to the Protocol will be considered.

Process for revising the Protocol

Due to the separation of responsibilities for housing energy efficiency matters between the State/Territory energy agencies and the building control Administrations, any changes to the Nationwide House Energy Rating Scheme that involve changes to the BCA Protocol should be:

- developed in consultation between the energy agencies and the building control Administrations within each State and Territory;

- documented by the Scheme's National Administrator;

- reflected in the 'Protocol' prepared by the ABCB;

- assessed for regulatory impact, in accordance with the requirements of the Office of Regulation Review (ORR) - public consultation is required by the ORR for significant changes; and

- referred to building control Administrations for agreement to amend the Protocol and the specific BCA reference.

Note that at the time of publishing this revision some software has been, or is being, revised. When those revisions are complete and the building control Administrations advise their acceptance of the changes, the BCA explanatory information referring to the software will be changed. However, BCA changes can only take place annually.

Other matters

In addition to the processes and criteria contained in this Protocol, some States and Territories may have additional requirements for house energy rating software to assure the reliability of the outcomes. These may include:

- **Contact details** for the Software Company, or agent, that is responsible for the software including matters relating to software validation, support, testing, documentation and updates.

- **Software validation** and a Quality Assurance framework for integrating feedback and concerns of software accuracy.

- **Testing** that incorporates a Quality Assurance program for rectifying software faults and inaccuracies, and an undertaking for carrying out version control.

- **Instructions** for the use of the software, including:
  - general software operating instructions and rating procedures (how to input the data) for all required building scenarios; and
  - details of all software functions and settings, and any software limitations.

- **Software support** including:
  - support for software use and rating procedure clarification, documentation of all technical deficiencies, and a help desk to provide timely information to users and assessors;
  - a procedure for the timely definition and publishing of rating procedures not included in the software documentation; and
  - a procedure for the timely definition and incorporation of proprietary materials and material systems not included in the software.

- **Documentation** for any State/Territory-based:
  - examination schemes (State based Home Energy Rating Schemes may require the examination of candidates in the use of mandated House Energy Rating Tools for accreditation purposes); and
  - auditing schemes (State based Home Energy Rating Schemes may require that a sufficient sample of ratings carried out is audited for quality control of Accredited Assessors).

ABCB PROTOCOL FOR HOUSE ENERGY RATING SOFTWARE

Version: 2005.1

Date: May 2005

1. Scope

This Protocol describes the essential elements of suitable software, including the star rating criteria referred to in the BCA Verification Methods JV1 and V2.6.2.1, as well as general requirements for software development and use such as documentation, testing, quality assurance and user training.

2. Purpose and context of use

This Protocol has been developed to specify the requirements for any energy rating software that is used as the thermal calculation method in the BCA Volume One Verification Method JV1 and the BCA Volume Two Housing Provisions Verification Method V2.6.2.1. Software in compliance with this Protocol can be used to demonstrate compliance with BCA Performance Requirements. These include simulation software and correlation software as well as other simplified software (see Clause 10).

3. Features of the software

3.1 General

All elements addressed by the software must be classified as either minimum features (see Clause 3.2) or optional features (see Clause 3.3).

All features addressed by the software must have appropriate instructions to enable the user to implement the features.

3.2 Minimum features (see Table 1a)

Details of the following elements must be addressed or alternatively, listed as 'limitations' if not addressed:

- floor and enclosure assembly;
- external walls, including the angle to the horizontal;
- roof and ceiling assembly, including the angle to the horizontal;
- vertical glazing, including the angle to the horizontal;
- roof lights;
- sealing against infiltration;
- natural ventilation;
- casual, sensible and latent heat loads; and
- overshadowing by building elements and adjacent structures.

3.3 Optional features (see Table 1b)

Details of the following elements should be addressed where the provisions for the elements are available:
- doors;
- special construction elements;
- zoning;
- heating equipment;
- cooling equipment;
- heating and cooling distribution systems; and
- control system.

3.4 Climate data

Climate data employed must be based on hourly recorded values and be representative of a typical year for the proposed locations.

Climate data must be obtained from the 28 Climate Regions listed in Table 2. Where the software does not include all locations, the limitation must be stated in accordance with Clause 10.

Appropriate climate data (such as Test Reference Year or Weather Year for Energy Calculations) must be obtained from the Australian Bureau of Meteorology.

3.5 Dwelling operational details

Details of how the dwelling is operated must include:

- internal sensible and latent heat load as in Table 3;

- thermostat setting in the range 20 deg. C to 21 deg. C for heating and 25 deg. C to 28 deg. C for cooling. The typical setting for each Climate Region is given in Table 4;

- assumptions about when and how heating and cooling plant is operated.
  The number of hours per day for which heating and cooling is available would be expected to be between 7 am to midnight, with values outside this range unlikely in other than exceptional circumstances; and

- infiltration and ventilation control.

4. Methods of assessment

The BCA Energy Efficiency Verification Methods (JV1 and V2.6.2.1) are available as a means for assessing compliance with Performance Requirements JP1 and P2.6.1. The definition of the nominated thermal calculation method permits the use of a software-based calculation model.

Any software used in the Verification Methods must be based on well-established models that are in accordance with the principles of thermodynamics and fluid mechanics. The calculation method used in the software must be documented and be available for inspection.

Sources of reference data on the thermal properties of building materials, insulation etc. must be identified and be from test results or authoritative data sources such as The Australian Institute of Refrigeration, Air-Conditioning and Heating or The American Society of Heating, Refrigerating and Air-Conditioning Engineers.

Any manipulation of the outcomes from the calculation model based on policy considerations (such as modification of results based on the area of the dwelling) must be clearly stated and submitted to the appropriate approval authority.

5. Output presentation

For the purposes of this Protocol, the outputs[a] must be presented in terms of energy loads of the building, in MJ/m^2 of floor area per annum for any particular climate region of Table 2 as:

a) heating and cooling loads separately (sensible and latent where available); and

b) combined heating and cooling load with associated 'star rating' in accordance with Table 5.

Inputs and outputs must be included on the documentation produced to demonstrate compliance with Verification Methods JV1 and V2.6.2.1.

6. Testing, Validation and Quality Assurance

Energy rating software, including any revisions, updates or new versions, is required to undergo appropriate testing, validation and quality assurance before being used for regulatory purposes. Records of testing and quality assurance must be kept and made available.

Simulation software must be validated in accordance with ANSI/ASHRAE Standard 140-2001 'Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs. The outcomes should be within the range of results from programs that are generally accepted as indicated in the Standard. While outcomes that fall outside this range are not necessarily incorrect, the sources of the differences must be investigated, documented and made known to the appropriate approval authorities. (this requirement will be effective from 2006 to allow software providers adequate time to carry out the necessary tests.)

Correlation software, or software based on correlating the results from complying simulation software, must undergo an appropriate testing regime to demonstrate its correlation to the complying simulation software.

7. Training of users

A training program for users must be available. This program must include training in the current version and any proposed new version of the software.

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[a] Outputs for the user may be presented in an alternative format such as star rating.

8. Evidence of suitability of software

Evidence must be produced to demonstrate that software complies with this Protocol. This will include evidence that:

a) the star rating complies with Table 5;

b) the software has undergone appropriate testing and quality assurance; and

c) a training program is available for users.

The status of the software, such as whether it has been approved by an appropriate authority, must also be clearly indicated.

9. Process for validating and upgrading software

Energy rating software used to demonstrate compliance with BCA Performance Requirements JP1 and P2.6.1 must meet the requirements of this Protocol.

The software providers are responsible for validating the software, upgrading the software when needed, and validating the upgrade.

The ABCB must be advised, in writing, of any new validated software and validated revisions to software, to ensure that building control Administrations, and in turn building officials, are adequately informed. Correspondence should be sent to:

> The Executive Director
> Australian Building Codes Board
> GPO Box 9839
> CANBERRA ACT 2601

Any revisions, updates or new versions must be identified by a unique number or other form of designation. The status of any revisions, updates or new versions, such as whether it has been approved by an appropriate authority, must also be clearly indicated.

The BCA is amended annually and published for adoption in May. To achieve these dates, advice of any change (including reasons for the change, validation details and a statement of the likely impact of the change), must reach the ABCB by no later than the end of July in the preceding year.

10. Development of simplified software for limited usage

Simplified Software developed to be used within a limited range of climatic regions or for a limited range of materials or other building characteristics must comply with the following:

- the limitations of the software must be clearly stated in all publications and outputs from the software;

- where the limitations are exceeded, there must be a warning that the input data is outside the range of the software and that the results may not be valid; and

- software that does not use hourly simulation must be benchmarked against validated software that uses hourly simulation across its full range of usage.

Table 1a. Minimum features to be included

Component	Feature
1. Floor and footing assembly	Construction type such as slab-on-ground, sub-floor space or basement, inherent and added insulation value, vented or unvented sub-floor space, any subfloor space enclosure, floor covering and thermal capacitance, and adjacency to other spaces.
2. External walls	Construction type, inherent and added insulation value, thermal capacitance, colour (such as light, medium or dark), shading, internal cavity size, whether the cavity is ventilated, and the orientation of the walls.
3. Internal walls and separating walls	Construction type, adjacency to other spaces and adjoining buildings.
4. Roof and ceiling assembly	Construction type, inherent and added insulation value, whether insulation is bulk or reflective insulation type, thermal capacitance, roof colour (such as light, medium or dark), vented or un-vented roof space, and roof and ceiling geometry.
5. Glazing	Construction type (including the frame material, the sealing and glazing characteristics, U-value and solar heat gain coefficient of complete assembly), the position, orientation, external and internal shading (such as internal blinds) and shading by building elements (including adjacent buildings).
6. Skylights or roof light	Construction type, U-value of complete assembly, solar heat gain (including any shading effects), orientation, slope angle, and length and size of well.
7. Ventilation and infiltration	The variable wind driven infiltration and degree of building sealing.
8. Natural ventilation	Window and door openings and breeze paths.
9. Casual loads	Sensible and latent heat gain, latent cooling loads and the fixed activity profiles.

Table 1b. Optional features which may be included

Component	Feature
Doors (only include if large)	Construction type, insulation value, orientation and sealing quality.
Special construction elements e.g. waffle-pod	Construction, insulation, vented and un-vented and thermal capacitance.
Sun spaces	Construction type, orientation, U-value, solar heat gain, external and internal shading and separating walls.
Multi-storey construction	Heat-mass transfer between zones.
Heating equipment	Equipment type, location, efficiency and part load characteristics.
Cooling equipment	Equipment type, location, efficiency and part load characteristics.
Heating and cooling distribution system	System type, location, insulation value of ductwork and piping and air leakage of ductwork systems.
Zoning	Different zoning for living, bedroom and unconditioned spaces.
Control systems	Thermostat type.

Table 2. Climate Regions

Climate No.	Location	Latitude (See note 1)	Longitude (See note 1)	Elevation (See note 2)
1	Darwin (Derby/Broome)	12°25' S	130°52' E	31m
2	Port Hedland (Onslow/Learmonth)	20°22' S	118°37' E	9m
3	Longreach PO	23°27' S	144°15' E	191m
4	Carnarvon AMO	24°53' S	113°40' E	4m
5	Townsville AMO (Cairns)	19°15' S	146°46' E	4m
6	Alice Springs AMO (Meekatharra/Giles)	23°49' S	133°54' E	545m
7	Rockhampton AMO (Mackay/Gladstone)	23°23' S	150°28' E	10m
8	Moree PO (Cobar/Woomera/Oodnadatta/ Charleville/Kalgoorlie/Forrest)	29°30' S	149°54' E	207m
9	Amberley	27°38' S	152°43' E	27m
10	Brisbane PO	27°29' S	153°02' E	38m
11	Coffs Harbour	30°19' S	153°07' E	5m
12	Geraldton	28°48' S	114°42' E	38m
13	Perth MO (Richmond-WA)	31°56' S	115°58' E	20m
14	Tamworth (Oakey)	31°05' S	150°51' E	404m
15	Williamtown (Ceduna)	32°48' S	151°50' E	9m
16	Adelaide PO	34°56' S	138°35' E	40m
17	Sydney (Mascot)	33°56' S	151°10' E	6m
18	Nowra (Albany/Esperance)	34°57' S	150°32' E	109m
19	Cloncurry (Tennant Creek/Mt Isa/Halls Creek)	20°40' S	140°31' E	189m
20	Wagga (Nhill)	35°10' S	147°28' E	221m
21	Melbourne (Laverton)	37°41' S	144°51' E	132m
22	East Sale (Essendon/Tullamarine/Mt Gambier)	38°06' S	147°09' E	5m
23	Launceston Airport	41°33' S	147°13' E	171m
24	Canberra City (Orange)	35°16' S	149°07' E	564m
25	Alpine (See note 3)			
26	Hobart Airport	42°50' S	147°30' E	4m
27	Mildura Airport	34°14' S	142°05' E	51m
28	Richmond-NSW	33°36' S	150°47' E	9m

Source: AIRAH Application Manual DA9

Note:

1   Latitude and Longitude relate to first listed location which is also the source of the weather data.

2   Elevation is the height above the Australian Height Datum.

3   Data for climate No. 25 Alpine may be synthesised rather than a single location.

Table 3. Sensible and latent heat loads (W.hr)

Period (for 1 hour from the time listed)	Living, family and kitchen		Bedrooms	
	Sensible	Latent	Sensible	Latent
Midnight	100	0	100	50
1:00 am	100	0	100	50
2:00 am	100	0	100	50
3:00 am	100	0	100	50
4:00 am	100	0	100	50
5:00 am	100	0	100	50
6:00 am	100	0	100	50
7:00 am	860	400	0	0
8:00 am	560	200	0	0
9:00 am	240	100	0	0
10:00 am	240	100	0	0
11:00 am	240	100	0	0
Noon	240	100	0	0
1:00 pm	240	100	0	0
2:00 pm	240	100	0	0
3:00 pm	240	100	0	0
4:00 pm	240	100	0	0
5:00 pm	610	150	0	0
6:00 pm	1610	750	0	0
7:00 pm	760	150	50	0
8:00 pm	760	150	50	0
9:00 pm	760	150	50	0
10:00 pm	100	0	100	50
11:00 pm	100	0	100	50

Note that the hours of operation are only for testing and validation purposes, and are not intended to reflect actual use.

Table 4: Typical thermostat set points

Climate region	Heating set point (°C)	Cooling set point (°C)
1	20	28
2	20	28
3	20	28
4	20	28
5	20	27
6	20	28
7	20	26
8	20	27
9	21	27
10	21	27
11	21	26
12	21	27
13	21	26
14	20	27
15	21	26
16	21	26
17	21	26
18	21	26
19	20	28
20	21	26
21	21	26
22	21	26
23	21	26
24	21	26
25	20	25
26	21	26
27	21	27
28	21	27

Table 5: Star rating criteria (MJ/m²·annum)

Climate Region	Variation	Star rating									
		0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
1		964	873	782	647	554	469	405	375	345	320
	Queensland	1035	870	705	540	510	480	450	420	395	370
2		883	813	743	613	543	447	405	384	365	335
	Queensland	870	740	610	480	440	400	370	340	320	300
3		890	715	540	365	338	310	288	265	245	225
	Queensland	890	720	550	380	355	330	300	270	240	210
4		440	395	350	305	263	220	183	145	123	100
5		500	425	350	280	225	175	143	120	110	100
	Queensland	555	470	385	300	275	250	225	200	185	170
6		640	575	510	445	393	340	273	205	168	130
	Queensland	825	660	495	330	300	270	240	210	195	180
7		366	310	254	190	149	108	91	73	70	58
	Queensland	400	330	260	190	170	150	130	110	90	70
8		780	680	590	500	420	360	308	270	230	200
	Queensland	725	570	415	260	230	200	180	160	140	120
	WA	700	650	600	550	475	400	340	280	245	210
9		570	480	400	335	290	245	213	190	170	148
	Queensland	450	360	270	180	160	140	120	100	85	70
10		550	450	380	310	240	190	150	130	105	90
	Queensland	355	290	225	160	140	120	105	90	75	60
11		570	460	370	300	235	190	153	135	110	100
12		485	450	415	380	325	270	235	200	160	120
13		425	390	355	320	270	220	180	140	115	90
14		630	550	480	415	355	305	270	240	200	165
	Queensland	645	500	355	210	180	150	135	120	105	90
15		450	400	350	300	260	220	190	165	142	120
16		575	500	425	350	325	300	275	250	230	210
17		550	470	400	330	265	210	170	145	125	110

Climate Region	Variation	Star rating									
		0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
18		560	485	415	350	290	242	207	180	158	135
	WA	585	550	515	480	405	330	260	190	165	140
19		845	770	695	620	545	470	413	355	320	285
	Queensland	890	730	570	410	380	350	325	300	285	270
20		605	560	515	470	423	375	345	315	283	250
21 & 22[1]		475	430	385	340	310	280	255	230	208	185
23		1120	950	780	610	575	540	483	425	368	310
24		590	540	490	440	400	360	330	300	273	245
25		1350	1100	950	800	700	600	500	413	330	250
26		877	740	603	465	430	395	353	310	263	215
27		475	440	405	370	333	295	268	240	218	195
28		560	485	418	350	296	242	211	180	158	135

Note:

1 The Nationwide House Energy Rating Scheme does not specify separate values for Climate Region 22. The values for Region 21 are also valid for Region 22.

2 Where a State or Territory is listed in the variation column, the values in that row are those determined by that State or Territory for that Climate Region within its jurisdiction. Where there is no jurisdiction listed in the variation column, the values in that row are applicable wherever that Climate Region exists.