Developing new heating and cooling load limits for updated NatHERS weather data

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2 Executive Summary

Before developing load limits for the updated weather data, the current load limits were checked against the NatHERS Dashboards developed by CSIRO to check that the policy intention of eliminating the worst 5% of heating and cooling loads was being maintained. These dashboards contain all the Universal Certificate data for ratings submitted for building permits since May 2016. This contains almost 4 times more data than the data used to develop the original load limits and the data has been subject to extensive quality control. CSIRO modified these dashboards to allow disaggregation of data by dwelling Class and floor type. The dashboards calculated the 95th percentile of heating and cooling loads for comparison with the load limits.

The dashboard data showed that there are still many climate zones with minimal construction data where load limits could not be derived. Only 30 of the 69 NatHERS climate zones had data for 20 or more dwellings for Class 1 on a slab floor which could be used to check the load limits.

Comparisons between the load limits and the dashboard data 95th percentiles showed that there had been some movement in the 95th percentiles of heating and cooling load since the development of the initial load limits. This is described in Section 3.2. These more up to date figures were used to develop load limits for the updated weather data.

Load limits were developed (as described in Section 4) for the updated weather data using a two-step process:

1. The relationship between energy loads predicted by AccuRate for the current and updated weather data was established using a correlation technique for heating and cooling loads. This correlated the energy loads for the 270 dwellings used to develop the star bands. The equation from this correlation was then applied to the current load limits to generate the new load limits.
2. The dwellings with the highest heating and cooling loads in each building Class, floor type and rating level were 'reality checked'. This involved comparing the percentage under or over compliance of the dwellings from the star bands sample with the highest heating and cooling loads in each climate with a load limit. Where the reality check showed a significant difference in the specifications for the current and updated weather load limits were modified. The results of the reality check process are show in Section 6. Changes to load limits as a result of the reality check process were made for only 10 cases. These are listed in Section 7.

Once load limits for the current 5, 5.5 and 6 star levels were derived for the updated weather data, load limits for higher stringency levels anticipated by the Trajectory (COAG Energy Council, 2018) of 6.5 stars and 7 stars were also derived. The load limits for these higher levels were developed by deriving a relationship between the star band MJ/m2 and the load limits and extrapolating this to 6.5 and 7 stars (see Section 5). Note that higher stringency may diminish the need for load limits. Load limits are needed because, for example, high performance in winter may allow higher loads in summer. As stringency rises industry will reach an upper limit for just how far they can lower heating loads cost effectively and may have to turn to more design changes which reduce cooling loads as a result.

Because the derivation of load limits at higher stringency is theoretical and not based on market data like the original load limits a cautious approach should be taken to their implementation.

The final load limits for all climates, classes and star rating levels are shown in Section 8 in a similar format to the ABCB load limit standard to allow easy comparison. Note that these tables also show load limits for climates where load limits are not required e.g. 5.5 stars in Melbourne. This has been shown for information only.

3 Introduction

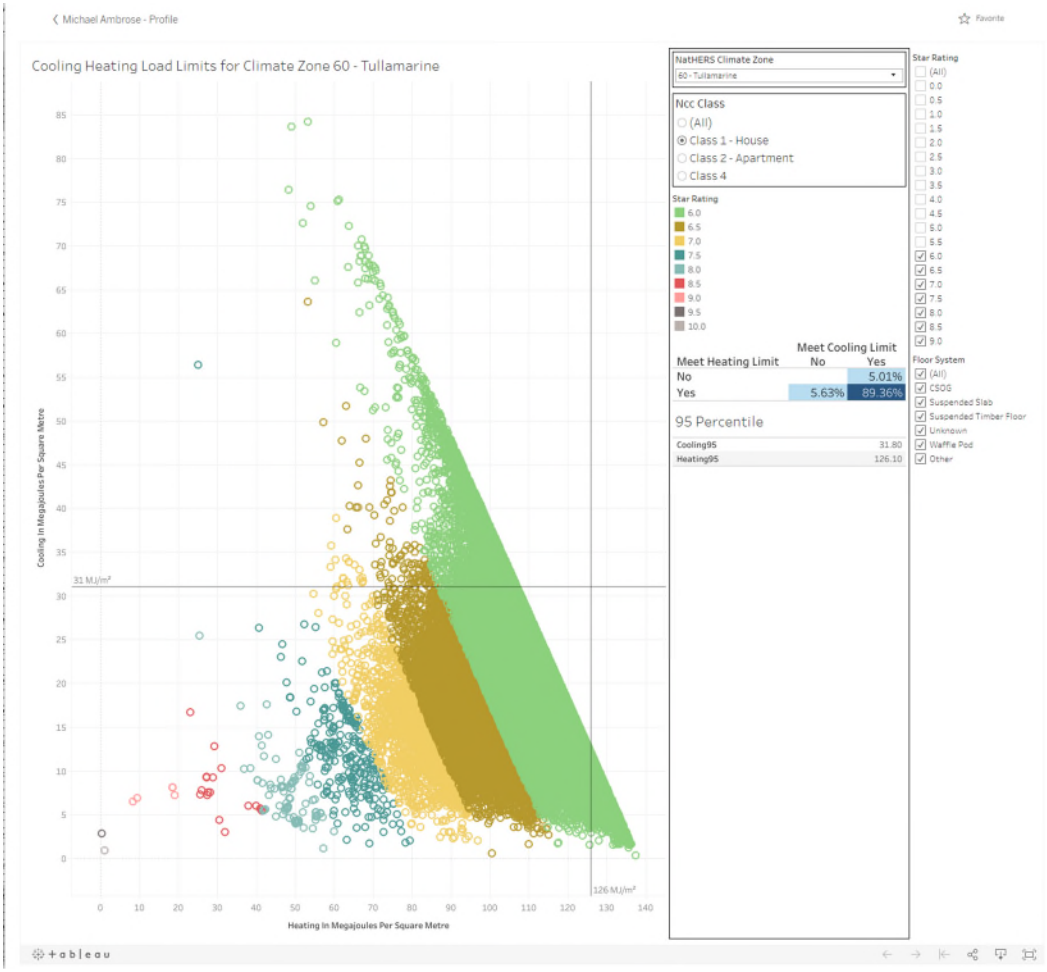
3.1 Development of the load limits

The heating and cooling load limits were developed for the ABCB in 2018 (Isaacs and Foster, 2018 and RIS Harrington, 2018) for those NatHERS climates where heating and cooling is greater than 5% of average energy loads. The load limits were established through interrogating NatHERS portal data from CSIRO and SV for 170,000 new building permits for Class 1 and Class 2 dwellings. Load limits were set to limit the heating and cooling loads to be no greater than the highest 5 percent of loads from the portals. The load limits are shown in an ABCB standard (ABCB, 2018) which is referenced by the NCC. Separate heating and cooling load limits are set for Class 1 dwellings which are wholly constructed on a concrete slab on ground floor or which contain a floor suspended over a subfloor space or the outdoor air. Class 2 dwellings have separate heating and cooling load limits which set the maximum load for any dwelling in an apartment building and another which sets the maximum average heating or cooling load for the building as a whole.

Load limits are not set for any climates which are wholly contained within NSW as the BASIX heating and cooling caps are used for these climates.

Since the development of the load limits CSIRO have merged the SV and CSIRO portals into a website that allows users to explore and analyse the data see: https://ahd.csiro.au/dashboards/energy-rating/. This data now includes 630,001 (as at January 2020) Class 1 and 2 new dwellings. The new portal data includes a representation of the heating and cooling loads for all NatHERS Universal Certificates issued within particular NatHERS climate zones in those locations where the load limits apply:

Figure 1 CSIRO dashboard showing heating and cooling load limits in Adelaide



3.2 Checking load limits against the more comprehensive dashboard data now available

The dashboard data now contains over 360% more dwellings than the initial portal data which was used to develop the load limits. If this more comprehensive data set was available to develop the load limits, it is possible that this would have affected the development of the load limits. The dashboard data includes Universal Certificate data from May 2016 onward. This includes most of the data used in the development of the load limits, although the data used for the development of the load limits does include some data from the FirstRate portal which preceded the HSTAR portal. This larger sample size means that the dashboard data is more representative of new dwellings construction than the data that the load limits were derived from. It is therefore important to check whether this larger data set would have affected the load limits to ensure that similar limits would have been developed with the larger data set.

The public dashboards do not currently differentiate between floor types for Class 1 dwellings or show maximum and average limits for Class 2 dwellings. A special version of the dashboards was constructed to allow comparison between the 95th percentile of heating and cooling loads from the current data set in the dashboards. This should correspond to the load limits which were designed to define the 95th percentile of loads from the data set that was available at the time.

Table 1 to Table 4 show the current 95th percentile of heating and cooling loads from the dashboards compared with the heating and cooling load limits in the 11 climate zones in Australia with the highest number of Class 1 ratings. Where the load limit is more than 10% lower than the current 95th percentile i.e. it may cut out too many dwellings the load limit is shown in **red bold font**. Where the load limit is more than 10% higher than the current 95th percentile i.e. it may let through too many dwellings, the load limit is shown in **green bold font**.

Table 1 Comparison of 6 star load limits with 95th percentile of loads from CSIRO dashboards Class 1 SLAB floors

Climate No.	Location	95th percentile of heating	Load limit heating	95th percentile of cooling	Load Limit cooling
9	Amberley	39.0	**33**	52.2	52
10	Brisbane	26.0	24	33.0	31
13	Perth	58.3	57	39.8	39
16	Adelaide	69.2	67	52.5	52
21	Melbourne	98.0	96	42.5	45
22	East Sale	126.3	123	32.6	**27**
24	Canberra	157.0	154	42.0	**38**
60	Tullamarine	129.8	126	32.8	31
62	Moorabbin	116.7	115	27.4	**24**
64	Cape Otway	120.3	119	24.8	**21**
66	Ballarat	191.3	189	29.0	26

For Class 1 dwellings on a slab floor (including Waffle Pod floor for cooler climates) the load limits generally agree well with the 95th percentiles of load found in the dashboards. The heating load limit in Amberley may be too low, and the Cooling load limits too low in Canberra and East Sale. This will be taken into account when reality checking load limits (see Section 4.2.2).

Table 2 Comparison of 6 star load limits with 95th percentile of loads from CSIRO dashboards Class 1 Suspended Timber floors

Climate No.	Location	95th percentile of heating	Load limit heating	95th percentile of cooling	Load Limit cooling
9	Amberley	33.4	34	50.2	47
10	Brisbane	28.0	28	32.0	31
13	Perth	40.4	38	53.4	**46**
16	Adelaide	56.9	55	59.2	59
21	Melbourne	92.8	88	48.8	47
22	East Sale	118.5	114.7	41.4	39
24	Canberra	146.0	143	51.5	47
60	Tullamarine	119.4	121	45.7	43
62	Moorabbin	109.8	109	33.0	34
64	Cape Otway	112.7	113	30.0	31
66	Ballarat	181.5	181	42.0	**48**

For Class 1 dwellings on a suspended timber floor the load limits generally agree well with the 95th percentiles of load found in the dashboards. The heating and cooling load limits in Perth may be too low. Given the issues that have been reported with light weight dwellings in Perth, some adjustment may be needed for the current heating and cooling load limits. This should be reported to the ABCB. This will be taken into account when reality checking load limits (see Section 4.2.2).

Table 3 Comparison of 6 star load limits with 95th percentile of loads from CSIRO dashboards Class 2 all floor types

Climate No.	Location	95th percentile of heating	Load limit heating	95th percentile of cooling	Load Limit cooling
9	Amberley	33.0	**48**	55.0	**44**
10	Brisbane	30.1	**25**	37.0	**32**
13	Perth	55.3	52	50.8	**41**
16	Adelaide	59.5	58	71.5	**53**
21	Melbourne	97.2	**88**	43.6	**36**
22	East Sale	ID*	118	ID*	23
24	Canberra	154.8	144	36.0	**31**
60	Tullamarine	125.7	**113**	43.2	47
62	Moorabbin	112.2	109	31.8	**26**
64	Cape Otway	ID*	113	ID*	20
66	Ballarat	ID*	178	ID*	28

*ID = insufficient data

The Class 2 dwellings 6 star average cooling load limit appears to be too high in all climates where there is adequate data except Tullamarine. The heating average 6 star limits in Brisbane and Tullamarine appear to be too low. This may indicate that the current load limits need further adjustment. This should be reported to the ABCB. This will be taken into account when reality checking load limits (see Section 4.2.2).

Table 4 Comparison of 6 star load limits with 95th percentile of loads from CSIRO dashboards Class 2 all floor types

Climate No.	Location	95th percentile of heating	Load limit heating	95th percentile of cooling	Load Limit cooling
9	Amberley	54.6	62	69.5	71
10	Brisbane	39.0	40	45.0	48
13	Perth	70.3	70	68.2	57
16	Adelaide	77.0	96	91.1	93
21	Melbourne	129.4	120	59.3	62
22	East Sale	ID*	157	ID*	40
24	Canberra	202.2	194	47.6	47
60	Tullamarine	167.5	160	59.3	48
62	Moorabbin	152.0	147	40.1	37
64	Cape Otway	ID*	147	ID*	37
66	Ballarat	ID*	233	ID*	50

*ID = insufficient data

The Class 2 5 star load limits describe the maximum load of any dwelling in a Class 2 building. This indicates that the 95th percentile of loads shows much better agreement than the 6 star load limits.

The differences in 95th percentile of loads and the current load limits are reason for concern, particularly the general trend for the cooling load limit to be significantly below the 95th percentile for cooling at 6 stars in Class 2 dwellings. These differences may indicate that the current load limits are inappropriate and should be adjusted.

Due to the significant issues noted above more extensive comparisons between the load limits and dashboard data were undertaken. The MJ/m^2 difference between the load limit and the 95th percentile of heating and cooling loads from the dashboards was sorted into ranges and the proportion of climates within each range is shown below.

Table 5 Summary of absolute differences between load limits and dashboard 95th percentile heating and cooling loads

Heat/Cool:	Heat				Cool			
Class:	1		2		1		2	
Floor:	Slab	Timber	Slab	Slab	Slab	Timber	Slab	Slab
Star:	6.0	6.0	6.0	5.0	6.0	6.0	6.0	5.0
No climates with >20 ratings:	31	26	13	11	31	26	13	11
MJ/m² difference Load Limit minus dashboard 95th percentile	% within MJ/m² range							
Load limit <9 lower	3%	4%	23%	0%	0%	8%	38%	18%
Load limit between 6 and 9 lower	3%	0%	8%	36%	6%	4%	8%	0%
Load limit between 3 and 6 lower	26%	4%	23%	9%	16%	8%	31%	9%
Load limit within 3 of 95th %ile	61%	69%	38%	27%	55%	69%	15%	64%
Load limit between 3 and 6 higher	0%	19%	0%	9%	3%	8%	8%	0%
Load limit between 6 and 9 higher	3%	0%	0%	9%	3%	0%	0%	0%
Load limit >9 higher	3%	4%	8%	9%	16%	4%	0%	9%

Note that there is greater agreement between the load limits and the 95th percentile for Class 1 dwellings on a slab floor than for other load limits. This is probably because Class 1 dwellings on a slab floor represent the

highest number of ratings in the dashboards (30 climates with 20 or more ratings). As the number of ratings decreases the extent of variation between the load limits and the 95th percentile loads increases.

Where the load limit is at a high level e.g. 194 for Canberra Class 2 5 stars, a 3 MJ/m^2 difference will not be significant. The percentage difference between the Load Limit and the 95th percentile loads from the dashboard was also examined. Table 6 shows how percentage differences in load limits compared to the 95th percentile of loads from the dashboard data.

Table 6 Summary of percentage differences between load limits and dashboard 95th percentile heating and cooling loads

Heat/Cool:	Heat				Cool			
Class:	1		2		1		2	
Floor:	Slab	Timber	Slab	Slab	Slab	Timber	Slab	Slab
Star:	6.0	6.0	6.0	5.0	6.0	6.0	6.0	5.0
No climates with >20 ratings:	31	26	13	11	31	26	13	11
Percentage difference between Load Limit and dashboard 95th percentile	% within MJ/m^2 range							
Load limit >15% lower	0%	23%	0%	13%	12%	54%	18%	0%
Load limit between 10 and 15% lower	8%	8%	0%	10%	8%	23%	0%	8%
Load limit between 5 and 10% lower	4%	23%	18%	13%	15%	8%	9%	4%
Load limit within 5%	65%	38%	64%	39%	46%	0%	64%	65%
Load limit between 5 and 10% higher	12%	0%	0%	6%	12%	8%	0%	12%
Load limit between 10 and 15% higher	8%	0%	9%	0%	4%	0%	0%	8%
Load limit >15% higher	4%	8%	9%	19%	4%	8%	9%	4%

These findings have two implications:

1. That the ABCB (and state regulatory building authorities) should carefully monitor the application of the load limits in those climates with significant differences between the dashboard data and the current ABCB load limit standard, and
2. That the development of load limits for the updated weather data should be based on the 95th percentiles from the dashboards as this was the original policy intent of the load limits.

Despite the fact that the dashboard data set contains over 600,000 ratings, not all NatHERS climate zones contain sufficient data to reliably calculate 95th percentile load limits. As shown in Table 5 and Table 6, only 30 (up from 25 in the original load limit sample) of the climate zones contain more than 20 Class 1 dwellings constructed on a slab floor. Further, the number of climate zones with sufficient data falls to 11 (up from 8 in the original load limit sample) when considering Class 2 dwellings rated at 5 stars. When the load limits were initially developed, the climate zones with insufficient data used an alternative methodology to develop their load limits.

The original load limits report suggested that a cautious and flexible approach be used in the implementation of the load limits and also suggested that load limits be updated when more data becomes available (Isaacs and Foster, 2018, p17):

> "The differences between the original star band data set and portal data were greatest in climates where the main wall construction type was high thermal mass [e.g. Perth which uses Brick Cavity and Alice Springs which uses Concrete Block]. While a correlation approach was used to overcome this limitation, this is a theoretical approach and as a result may not as accurate. It may inadvertently capture more or less than 10% of outliers as a result. The method 2 load limits are a robust, however, there is no substitute for real data. It is recommended that the ABCB carefully monitor the outcomes delivered in those climates where this approach is used as it may need adjustment when more field data becomes available."

There are around 30-40 NatHERS climate zones with very low construction volumes. Provided that the same cautious and flexible approach is used in the implementation as recommended in the original report, it is less important to develop load limits in these climates with the same degree of precision as in those climates where there are high construction volumes because the implications for industry are so much smaller. It is therefore suggested that, as there is still no better data for these low construction volume climate zones, no change to the original load limits is needed.

4 Methodology

4.1 Initial methodology was rejected

The initial methodology developed for this project was, in summary, to use the dwellings developed for the heating and cooling load limits RIS (Harrington, 2018, based on data from Isaacs, 2018) which provided examples of dwellings which just met the heating and cooling load limits to develop the load limits for the updated weather data. This initial methodology would use these 'just complaint' dwellings, optimise them to achieve appropriate star rating with the updated weather data and then record the heating or cooling load predicted by AccuRate and use this as the new load limit. This methodology was tested in 3 climate and rejected because:

1. In a number of climates, the balance of heating and cooling loads with the updated weather data had changed.

   The impact of updated weather data in some climates was so significant that, on average, the highest load changed from heating to cooling e.g. Brisbane, while in other climates the reverse was true. This change would likely affect the market response to the rating e.g. in Brisbane there would be a greater focus on design strategies which would lower cooling loads. It was not clear exactly how much this would affect the market response, but a methodology which tested how the market response would change was needed, and

2. In some climates there were significant changes to the rating of individual dwellings – both increases and decreases in excess of 0.5 stars - with the updated weather and star bands. This will also affect the market response to the rating. A load limit set at 6 stars with the old weather data may therefore no longer be appropriate.

4.2 Updated methodology

A new methodology was developed to calculate load limits for the updated weather data. In summary a 3-step methodology was developed:

1. Derive interim load limits by establishing the relationship between heating and cooling loads with the current weather data and the updated weather data,
2. Use the dwellings which have the highest heating and cooling loads from the star band development process to provide a reality check of the new limit.

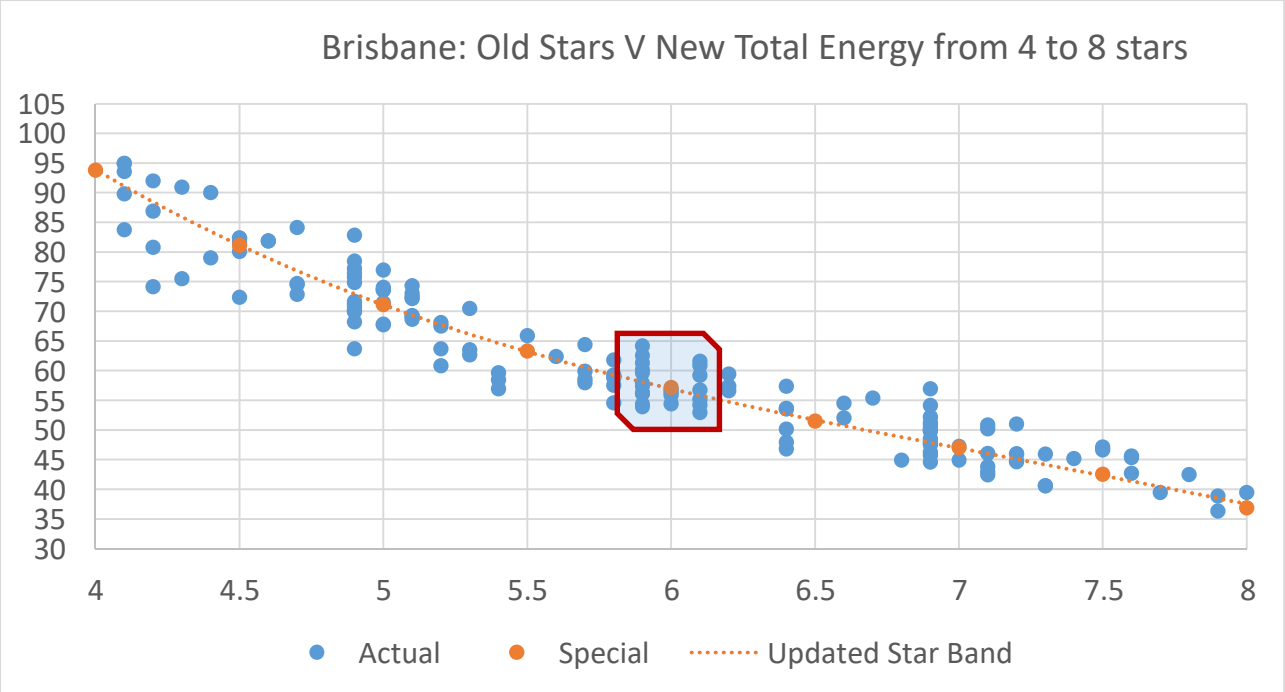
The following sections describe each of the 3 steps in greater detail.

4.2.1 Step 1: Deriving interim load limits

The development of the star bands involves running 270 dwelling simulations per climate zone. This data provides NatHERS simulated heating and cooling loads for the same dwelling set for both the current and updated weather data. This allows the relationship between heating and cooling loads predicted with current and updated weather data to be established.

Figure 2 below shows the variation in total energy loads in Brisbane using the new weather data from 4 to 8 stars. The orange dotted line shows the energy load required to achieve ratings between 4 and 8 stars with the new weather data. The total energy loads at 6 stars (5.9 to 6.1) are shown highlighted. This shows that the simulated total energy load for 6 star houses can vary by around +/- 5 MJ/m^2.

Figure 2 Energy loads of dwellings simulated with updated weather data versus rating in current version of AccuRate



Despite the variation in the total of simulated heating and cooling loads with updated weather data, the individual heating and cooling loads show a strong correlation with R squared values in excess of 0.99. Figure 3 and Figure 4 show how heating and cooling loads vary in Brisbane.

Figure 3 Heating loads in Brisbane with current (old) and updated (new) weather data

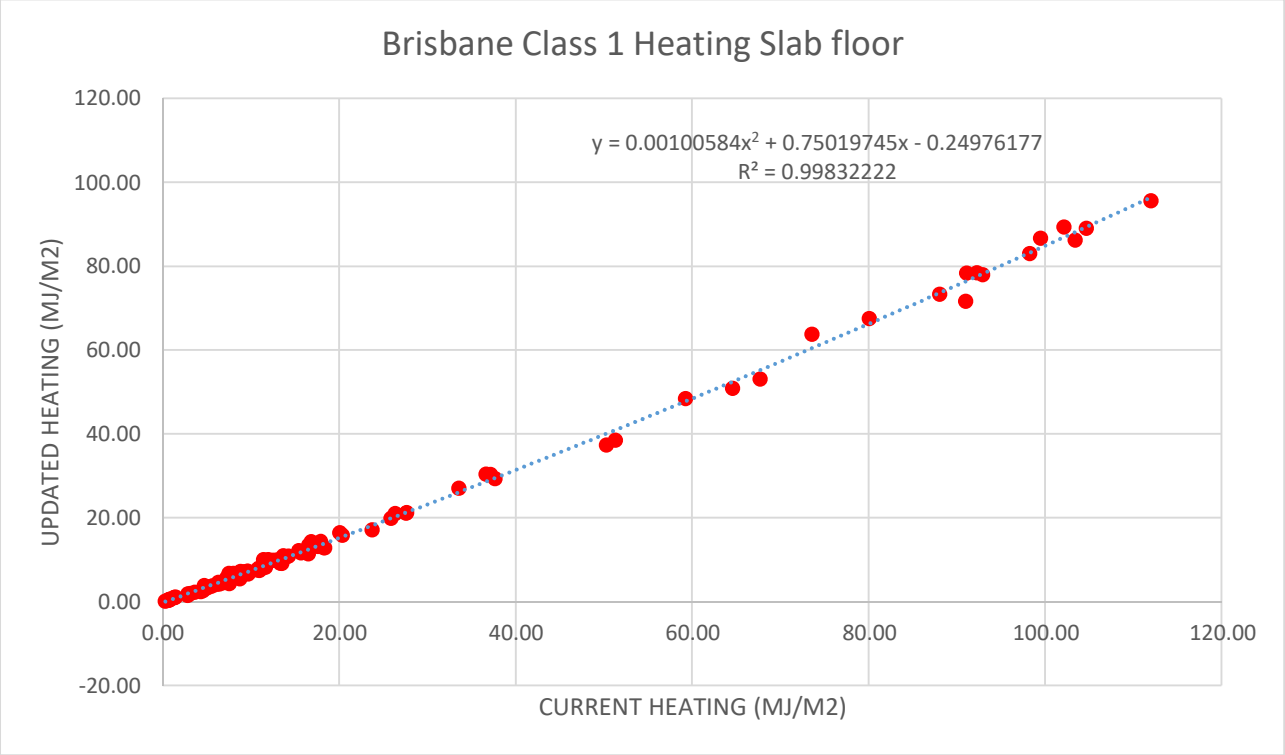
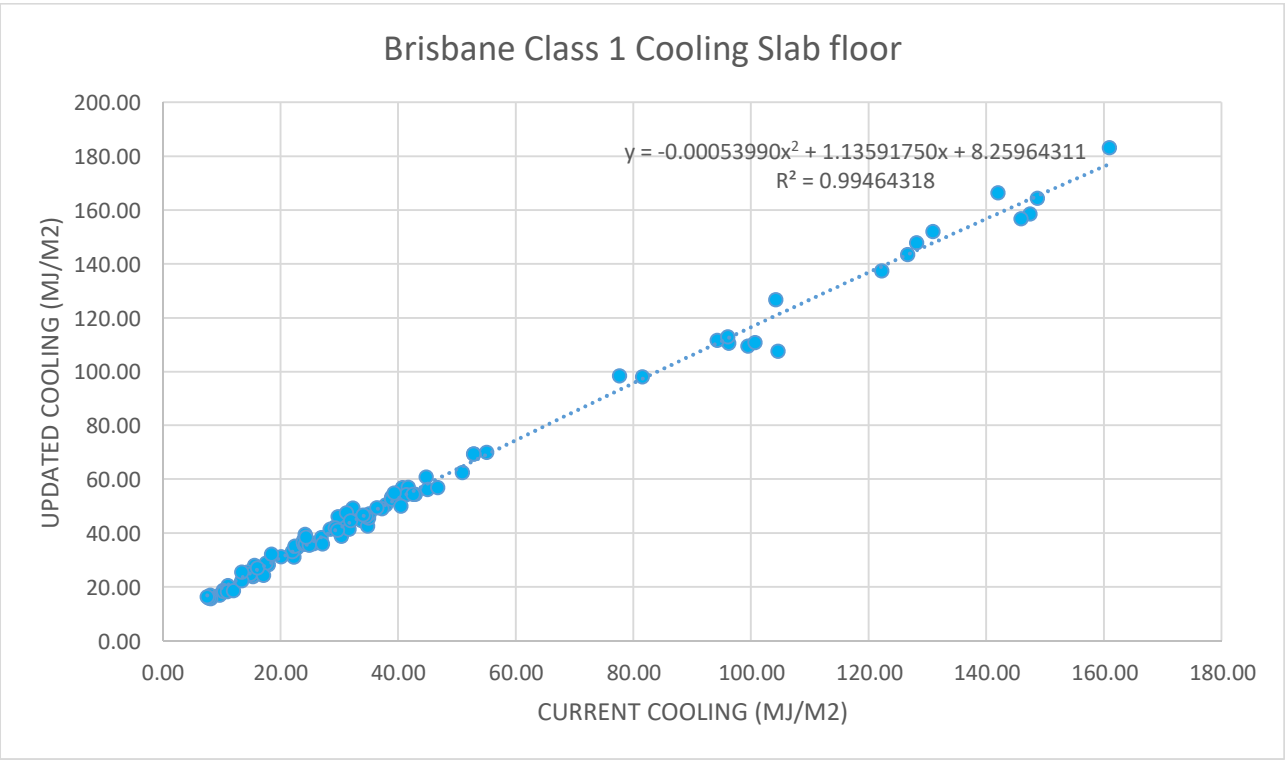


Figure 4 Cooling loads in Brisbane with current (old) and updated (new) weather data



The equation describing the relationship between energy loads simulated by Chenath with current and updated is applied to the current load limit- adjusted to reflect 95th percentile of portal data where appropriate - to derive the updated interim load limit.

4.2.2 Step 2: Reality checking the load limit

The load limits are derived by developing a relationship between the simulated loads with current and updated weather data and adjusting for stringency effects. This is still a theoretical approach, so the final step is to examine how the new load limits actually affect dwelling design and construction in the field. To do this, the dwellings with the highest heating and cooling loads in each climate are examined for the following cases:

1. Class 1 dwellings with a concrete slab on ground floor at 6 stars
2. Class 1 dwellings with a timber floor over a sub floor space at 6 stars, and
3. Class 2 dwellings at 5 and 6 stars,

In general terms, if the dwelling exceeds the current limit with the current weather and also exceeds the updated limit with the updated weather by a similar percentage amount, then the updated limit is simply mirroring the behaviour of the current load limits. Similarly, if the dwelling loads are under the load limits for current and new weather data by a similar proportion then that too indicates that the updated load limits are simply mirroring the behaviour of the current load limits.

Where a dwelling does not currently comply with load limits but does with the updated limits or vice versa or the percentage of over or undercompliance changes significantly then further investigation is undertaken:

- The dwelling heating or cooling load is compared to the load limit:
- The difference between the dwelling load and the load limit is calculated in MJ/m^2,
- The dwelling load as a proportion of the load limit is calculated,
    - If the difference between the dwelling load and the load limit has changed by more than 3 MJ/m^2, and the dwelling load as a proportion of the load limit has changed by more than 8% then the dwelling is selected for a reality check.
    - The dwelling is modified to achieve a load which represents the same proportion of the load limit with the updated weather data that it achieved using the current weather data.
- The extent of change to maintain the dwelling load at a similar proportion of the load limit is evaluated:
    - If simple low-cost measures such as modifying colours or increasing ceiling fan diameters are all that is needed to maintain the performance of the dwelling, then the load limit is kept at the value derived through the star band development process.
    - Where higher cost measures are required such as increasing insulation levels across multiple building elements, then this implies that the cost of meeting load limits will be significantly different to that predicted by the RIS. In this case, in order to protect the integrity of the load limits RIS, the load limit is modified.
- Dashboards were examined to determined the current failure rate. If this exceeds the intended 5% then the load limit is increased and vice versa, particularly where the reality check costs of compliance would support this.
- Where load limits are modified these are calculated by multiplying the load limit derived from the heating and cooling load correlation process by the ratio of the load and load limit with updated weather data with the ratio for the current weather data.
- This means that if the dwelling energy load as a proportion of the load limit is higher with the updated weather data the load limit is increased and if it is lower, the load limit is decreased.
- Because the load limits derived through this process are ‘theoretical i.e. have not been derived through observing the market response to the rating with the updated weather data a cautious approach was taken. In general, load limits were only increased as a result of this process unless the reality check made it abundantly clear that lowering the load limit would not adversely affect the cost of compliance.

5 Developing Load Limits for 6.5 and 7 stars

5.1 Issues around developing load limits for higher star ratings

The current load limits developed for 5 to 6 stars were based on historical heating and cooling loads taken from the NatHERS Universal Certificate portal data. Where there was an insufficient number of building permits in a climate zone to enable the load limits to be calculated directly, a second methodology was used which referenced a database of existing simulation results for a sample of dwellings. To develop new load limits for the updated weather data for 5 to 6 stars, the load limits are derived by taking the existing load limits and adjusting these for the change in simulated loads due to the change in weather data and then "reality checked" as described above.

The original portal data used for the development of load limits does not contain a sufficient number of dwellings at 6.5 and 7.0 stars to enable the worst 5% of heating and cooling loads to be established in all but a few climates. Further, the database of simulation results used for the secondary methodology contains insufficient 6.5 and 7.0 star rated dwellings to enable these results to be used to establish load limits. In addition, there is no RIS available which describes the extent of changes to dwelling design and modification as a reference point to use for reality checks.

The NatHERS portal data is now available through the CSIRO dashboards and contains four times as many ratings as was used to develop the load limits originally. Similar representations of the heating and cooling loads are available to that used for the original development of the load limits (see Figure 1), however, far fewer dwellings with ratings of 6.5 and 7.0 stars are available than at 5, 5.5 and 6 stars e.g. even in Climate zone 60 which has the greatest number of Class 1 dwellings only 2.2% achieve a rating of 7.00 to 7.49 stars (compared to 86.1% at 6.00 to 6.49 stars). There are only 14 dwellings in the dashboards in this climate which achieve a 7.00 to 7.49 stars rating on a suspended timber floor. Further, the design response to 7 stars of these houses may not reflect the approach that may be adopted by the industry because these houses reflect the design decisions of the higher end of the market who want to exceed regulatory minimums. As a result, the data from the dashboards may not provide a suitable precedent for the load limits at higher ratings levels.

The additional uncertainty around the establishment of the 6.5 and 7.0 star loads limits means that industry may need more time to test the implications of the new limits across all climate zones than may be allowed under the usual NCC consultation processes. The limits themselves may need to be amended after experience in the field.

It is possible that implementation of regulations at higher stringency could diminish the need for load limits. The primary driver for the introduction of load limits was concern that dwellings in cool and mild climates were able to comply with minimum regulation mainly by minimising heating loads. This led to poor summer performance in some dwellings. As stringency rises industry will reach an upper limit for just how far they can lower heating loads cost effectively and may have to turn to more design changes which reduce cooling loads as a result.

The section below explains the methodology developed for calculating load limits at 6.5 and 7.0 stars.

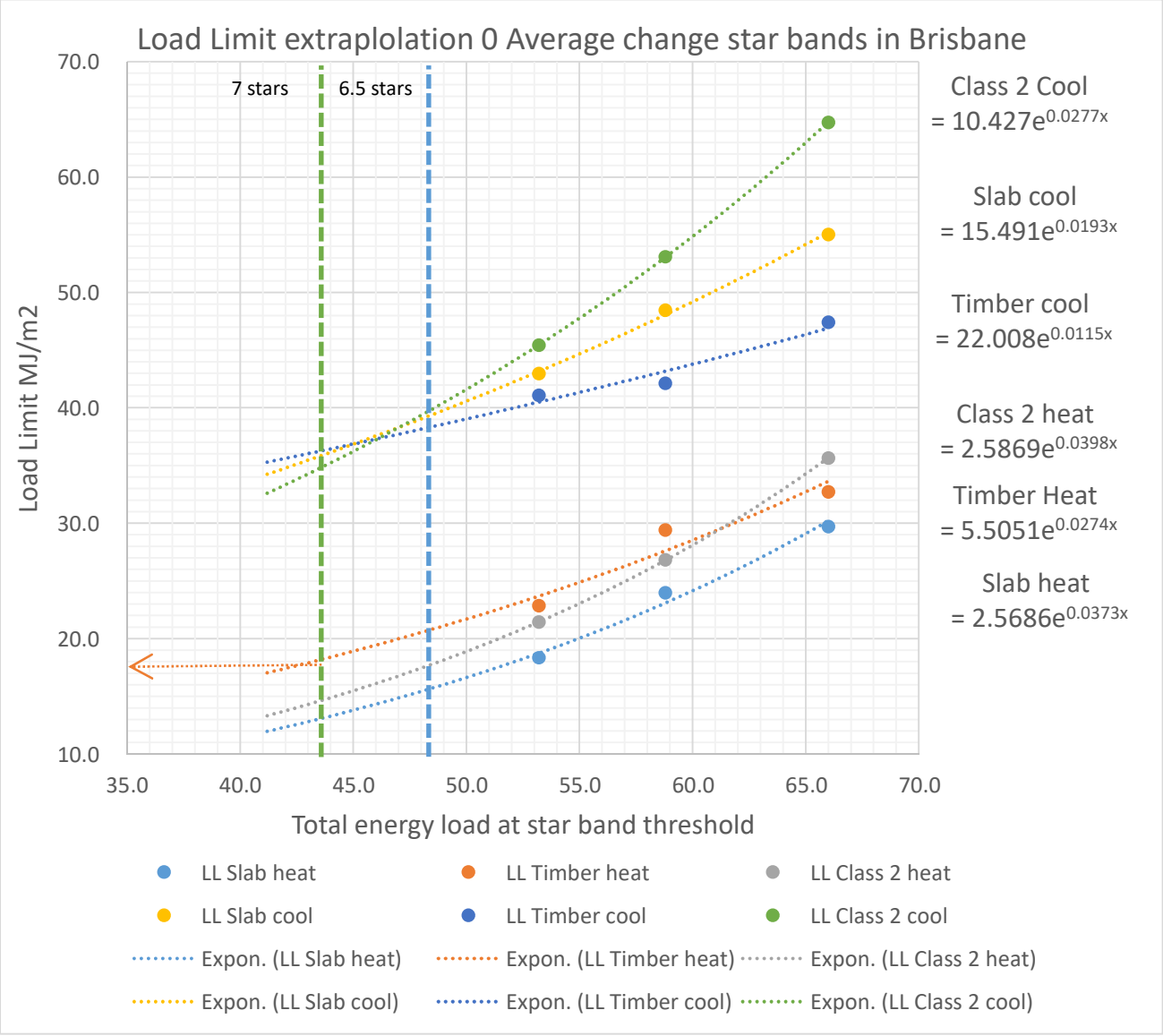
5.2 Methodology for the calculation of 6.5 and 7.0 star load limits

The methodology for calculating load limits at higher levels than 6 stars is relatively straightforward. The load limits for 5, 5.5 and 6 stars are plotted against the star band thresholds for these rating levels and the 6.5 and 7.0 star limits are calculated by extrapolation. An exponential extrapolation is used for two reasons:

1. It leads to diminishing gaps between the load limits as the star rating increases. This is similar to the general trend with both the current load limits and the star bands themselves, and
2. this gave higher load limits. Due to the greater uncertainty around the establishment of these load limits, a more conservative approach is appropriate to ensure that no undue regulatory burden is placed on industry.

Figure 5 shows an example of the extrapolation process for the Brisbane climate zone.

Figure 5 Example of load limit extrapolation for Brisbane



The dots represent the current load limits at 5.0, 5.5 and 6.0 stars. The thin dotted lines show the exponential curve of best fit to these load limits at 5 to 6 stars. The vertical thick solid lines show the 6.5 (blue) and 7.0 (green) star levels. The point at which the thin dotted curve fit crosses the star band threshold represents the load limit for that star value. For example, the timber floor load limit for heating at 7 stars is around 18 MJ/m^2 as shown by the arrow.

6 Results of reality checks: 0 star average change to ratings

The initial load limits were set by correlating the heating and cooling loads predicted by Chenath with the current and updated weather data as described in section 4.2.1.

Reality checks were performed to check whether the extent of change to building design and specifications with the initial load limits would significantly change the building specifications (either increase or decrease) required to achieve the load limits and therefore change the cost of compliance.

To evaluate whether the load limits developed for updated weather data did not significantly alter the nature of compliance the load of the dwelling with the highest heating and cooling load from the star bands sample were compared to the load limit. Ideally a dwelling which was 10% over/under the load limit would remain 10% over/under the load limit with the updated weather data. This would indicate that the load limit was working with the updated weather data in the same way as the current load limits.

The reality check evaluated the design and specification changes needed to make the dwelling over or under comply with the load limit by the same amount with the updated weather data as was observed with the current weather data e.g.:

> if the limit with current weather data 100 MJ/m^2 and the dwelling load was 80 MJ/m^2 using the current weather data and the load limit using the updated weather data is now 110 MJ/m^2, then the dwelling was modified to achieve a load of 80 (current load) / 100 (current limit) * 110 (updated limit) = 88 MJ/m^2.

If the initial load limits do result in an unwarranted increase or decrease in specification, then a new method of developing load limits is required. This involved modifying the initial load limit obtained through correlation (initial limit) so that the extent of over or under compliance for each dwelling was maintained at the same level of over or under compliance with both the current and updated weather data (adjusted load limit).

Load limit reality checks were performed if the difference between the dwelling load and the load limit with the current and updated weather data has changed by more than 3 MJ/m^2, and the dwelling load as a proportion of the load limit has changed by more than 8%.

Examination of the CSIRO dashboards showed that only 30 of the 69 NatHERS climates contained more than 20 ratings at each building Class, rating level and floor type which would allow load limits to be derived from field data. This meant that the initial development of the load limits was based on an alternative technique (called Method 2 in the load limits report (Foster and Isaacs, 2017)). While this technique is robust, a cautious approach to the implementation of the load limits was suggested. Consistent with this cautious approach, if the adjusted load limit was lower than the initial load limit i.e. more stringent, a change to the load limit was not recommended.

The following tables show the results of reality checks. They also show the revised load limits if these reality checks indicate that the extent of design and specification changes imply that the initial load limit may have a significant impact on compliance costs. The table blow explains the data shown in these tables.

Table 7 Guide to reading load limit reality check tables

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
1	2	3	4	5	6	7

1. The NatHERS climate zone the reality check was conducted in,
2. The dwelling number (plans of dwellings available in the main star bands report) and the base climate (as described in the star bands report) where the initial rating was conducted. This can be significant if construction types in the base climate were significantly different to the climate where the reality check is undertaken e.g. if a house from the Perth Climate was used then it will have brick cavity walls. The implications of the difference in the construction types between the climate being checked and the base climate is noted in the tables below.
3. Initial load limit derived by correlating Chenath predicted energy loads for the current and updated weather data.
4. Load limited adjusted so that the extent of over or under compliance for each dwelling was maintained at the same level of over or under compliance with both the current and updated weather data.
5. Comments on the extent of change to building specifications needed or the availability of data in the CSIRO NatHERS dashboards.
6. Recommendation to change the initial load limit or adopt the adjusted load limit. If the initial load limit should be used, then the recommendation is to not change the load limit (i.e. from the initial to the adjusted). If the adjusted load limit is recommended for use the recommendation is to change the load limit (i.e. from the initial to the adjusted).
7. Which of the initial (column 3) or adjusted (column 4) load limit is recommended to be used.

6.1 Class 1 Heating Load limit, Slab floors, 6 stars

Table 8 Reality check: Class 1 Heating Load limit, Slab floors, 6 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
21 Melbourne	SBH 05 (Melbourne)	55	60	Only requires an increase in wall or ceiling insulation of R0.5 to achieve compliance.	Minimal cost implication, so no change to limit required.	54
51 Forrest	SBH 03 (Perth)	62	68	No construction in Forrest since May 2016 according to CSIRO dashboards. House tested was uninsulated Brick Cavity. If framed walls used would easily comply.	No change recommended.	62

6.2 Class 1 Cooling Load limit, Slab floors, 6 stars

Table 9 Reality check: Class 1 Cooling Load limit, Slab floors, 6 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
10 Brisbane	SBH 09 (Brisbane)	43	48	Modifications only require small changes to colours and ceiling fan diameters. However, dashboards show that 10% of dwelling would currently fail the cooling limit.	***Increase in load limit recommended.***	***48***
14 Armidale	SBH 04 (Hobart)	13	20	Significant changes. In addition to changing all external element colours, required additional ceiling fans and increased tint to glazing.	***Increase in load limit recommended.***	***20***
53 Ceduna	SBH 11 (Melbourne)	43	39	Small changes required such as change to colours. While construction numbers are low, currently only 2.2% of dwelling fail the Ceduna load limit, so no further relazing is justified.	No change recommended.	43

6.3 Class 1 Heating Load limit, Non-Slab floors, 6 stars

Table 10 Reality Check: Class 1 Heating Load limit, Non-Slab floors, 6 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
10 Brisbane	SBH 08 (Carnarvon)	23	26	R0.5 added to wall, floor and ceiling insulation as well as R1.5 added to internal wall to garage. This would significantly increase cost of compliance. Currently slightly more houses fail the load limit than the intended 5% - 6.4% fail - so a small increase would be justified.	***Increase to load limit is recommended***	***26***

6.4 Class 1 Cooling Load limit, Non-Slab floors, 6 stars

Table 11 Reality Check: Class 1 Cooling Load limit, Non-Slab floors, 6 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
9 Amberley	SBH 01 (Mascot)	43	45	Amberley cooling loads have decreased with updated weather data. Dashboards show around 97% of houses in Amberley on timber floors meet the current cooling limit so increase is not likely to be needed.	No change recommended.	43
14 Armidale	SBH 01 (Canberra)	21	24	Added 3 ceiling fans. Not a huge cost. While construction volume is low, currently over 30% of dwelling fail the load limit, so a small increase would be justified.	***Change to load limit recommended.***	***24***
44 Kalgoorlie	SBH 01 (Perth)	53	60	House tested was from Perth and has Brick Cavity Walls which is not a common construction type in Kalgoorlie. If cooling load compliance is higher with high mass walls, then it will be even more demanding with framed walls.	***Change to load limit recommended.***	***60***
45 Woomera	SBH 06 (Moree)	42	46	Very low construction volume in Woomera, so initial load limit derivation was not based on construction data. Currently 20% of houses would not meet load limit in Woomera.	***Change to load limit recommended.***	***46***
54 Mandurah	SBH 05 (Adelaide)	36	32	Change to load limit would be a small decrease. Dashboards show only 83% of timber floored houses meet the load limit in Mandurah.	***Change to load limit recommended***	***32***

6.5 Class 2 Heating limit 6 stars

Table 12 Reality Check: Class 2 Heating limit 6 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
14 Armidale	SBH 21 (Hobart)	163	143	Armidale heating loads have increased with new weather data. No construction data in dashboards.	Change not recommended to take cautious approach in absence of construction data.	163
19 Charleville	SBH 21 (Longreach)	62	72	Both current and existing weather data house complies easily with minimal changes to colours needed to achieve same level of compliance with updated weather data. Cooling loads are double heating loads in Charleville. No data in this climate for Class 2 at 6 stars.	No change recommended.	63
21 Melbourne	SBH 20 (Melbourne)	55	64	South facing apartment on lower floor over open car park. Star rating for this unit drops to 5.7 stars with updated weather data. Improvements to 6 stars still leave heating well over 55 MJ/m2.	***Increase to load limit recommended.***	***64***
47 Bickley	SBH 21 (Adelaide)	75	69	No Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	75
49 Katanning	SBH 20 (Adelaide)	106	95	No Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	106
50 Oakey	SBH 20 (Adelaide)	78	67	Minimal data available, but already shows 10% of units do not meet the load limit.	Load limit not decreased to take cautious approach.	78
51 Forrest	SBH 20 (Perth)	65	59	No Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	65

6.6 Class 2 Cooling Limit 6 stars

Table 13 Reality check: Class 2 Cooling Limit 6 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
8 Moree	SBH 27 (Moree)	72	64	Use of correlation limit would significantly reduce the size and number of ceiling fans. Moree climate on average has around 50% of energy loads needed for cooling.	***Change to load limit recommended to ensure features needed to reduce cooling demand are maintained.***	***64***
14 Armidale	SBH 24 (Canberra)	11	9	Minimal difference to specifications required for loads to achieve same proportion of load limit as current.	No change recommended.	11
19 Charleville	SBH 22 (Longreach)	60	63	Current rating had dark colours. Same proportion of load limit can be achieved with slightly slighter colours.	No change recommended.	60
20 Wagga	SBH 20 (Melbourne)	26	29	Small construction volumes but dashboards show only 1.7% of ratings fail the current load limits., so no need to increase load limits.	No change recommended.	26
47 Bickley	SBH 23 (Adelaide)	42	33	No Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	42
50 Oakey	SBH 23 (Perth)	35	38	Very low Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	35
51 Forrest	SBH 23 (Adelaide)	45	41	No Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	45
53 Ceduna	SBH 23 (Adelaide)	46	41	No Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	46
57 Manjimup	SBH 23 (Melbourne)	21	18	No Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	21

6.7 Class 2 Heating Limit 5 stars

Table 14 Reality check: Class 2 Heating Limit 5 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
12 Geraldton	SBH 20 (Adelaide)	53	47	Minimal changes required to colours to maintain the load limit proportion with the new weather data.	No change recommended.	53
14 Armidale	SBH 20 (Canberra)	212	185	Minimal changes required to colours to maintain the load limit proportion with the new weather data.	No change recommended.	212
21 Melbourne	SBH 20 (Melbourne)	78	90	Significant increases to wall and floor insulation and some changes to colours. Would increase compliance cost significantly.	***Change to load limit recommended.***	***90***
49 Katanning	SBH 20 (Adelaide)	141	125	No Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	141
50 Oakey	SBH 20 (Adelaide)	103	87	Minimal Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	103
51 Forrest	SBH 20 (Adelaide)	87	79	No Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	87

6.8 Class 2 Cooling Limit 5 stars

Table 15 Reality check: Class 2 Cooling Limit 5 stars

NatHERS Climate	Dwelling number (rated originally for base climate)	Initial load limit from correlation	Adjusted load limit	Outcome of reality check and comments	Recommendation	Recommended Load Limit
8 Moree	SBH 27 (Longreach)	109	93	Minimal changes required to colours to maintain the load limit proportion with the new weather data.	No change recommended.	109
24 Canberra	SBH 27 (Hobart)	52	46	Minimal changes required to colours to maintain the load limit proportion with the new weather data.	No change recommended.	52
43 Oodnadatta	SBH 23 (Alice Springs)	110	102	No Class 2 construction data in this climate.	Load limit not decreased to take cautious approach.	110
47 Bickley	SBH 23 (Adelaide)	62	49	No Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	62
52 Swanbourne	SBH 23 (Perth)	47	34	Minimal Class 2 construction in this climate at 5 stars.	Load limit not decreased to take cautious approach.	47
53 Ceduna	SBH 23 (Adelaide)	67	60	No Class 2 construction in this climate in dashboards.	Load limit not decreased to take cautious approach.	67

7 Modifications to load limits as a result of reality checks

The table below summarise the changes to the load limits recommended in section 4.

Table 16 Summary of changes to load limits from reality checks

NatHERS Climate	Class 1 or 2	Heating/Cooling	Floor	Rating level	Initial Limit	Recommended limit
10 Brisbane	1	Cooling	CSOG	6	43	48
14 Armidale	1	Cooling	CSOG	6	13	20
10 Brisbane	1	Heating	Suspended	6	23	26
14 Armidale	1	Cooling	Suspended	6	21	24
44 Kalgoorlie	1	Cooling	Suspended	6	53	60
45 Woomera	1	Cooling	Suspended	6	42	46
54 Mandurah	1	Cooling	Suspended	6	36	32
21 Melbourne	2	Heating	NA	6	55	65
8 Moree	2	Cooling	NA	6	72	64
21 Melbourne	2	Heating	NA	5	78	90

8 Appendix Load Limits for updated weather data

The tables below show the load limits presented in a similar format to the ABCB Standard: NatHERS heating and cooling load limits 2019.1. The table numbers shown above the tables relate to the table numbers shown in this standard. Any climate zone in the table where the row has a grey background does not have a load limit. In some instances, the development of the load limits required information to be extracted from the original load limit research for some star rating levels which did not require load limits in that climate. Typically, this will be the 5.5 and 5.0 stars load limits which generally only apply to climates where an allowance is made by the NCC for an outdoor living area. These load limits are shown for information but should not be taken to imply that this load limit is in use.

Tables 1 to 8 cover the existing load limits from 5 to 6 stars for the updated weather data. Tables 9 to 11 cover 6.5 stars, and tables 12 to 14 cover 7.0 stars for the updated weather data.

Table 1 Class 1 CSOG – Heating and cooling load limits applying to NatHERS 6 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	5	54
5	N/A		
6	Qld	45	79
7	Qld	15	102
8	Qld, SA	66	59
9	Qld	40	47
10	Qld	18	48
11	N/A		
12	WA	29	40
13	WA	60	39
14	Qld	159	20
15	N/A		
16	SA	62	42
17	N/A		
18	N/A		
19	Qld	54	65
20	Vic	100	43
21	Vic	57	44
22	Vic	126	16
23	N/A		
24	ACT, Vic	146	39
25	N/A		
26	N/A		
27	Vic, SA	80	48
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
40	WA	23	91
41	WA	24	81
42	WA	24	80
43	SA	35	76
44	WA	51	44
45	SA	72	37
46	N/A		
47	WA	85	42
48	N/A		
49	WA	115	29
50	Qld	71	30
51	WA	63	45
52	WA	30	37
53	SA	59	43
54	WA	34	30
55	WA	47	19
56	N/A		
57	WA	92	33
58	WA	70	10
59	SA	216	17
60	Vic	113	32
61	Vic, SA	133	17
62	Vic	93	27
63	Vic	136	15
64	Vic	109	13
65	N/A		
66	Vic	192	28
67	N/A		
68	N/A		
69	N/A		

Table 2 Class 1 SF – Heating and cooling load limits applying to NatHERS 6 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	11	54
5	N/A		
6	Qld	55	79
7	Qld	21	104
8	Qld, SA	65	64
9	Qld	41	43
10	Qld	26	41
11	N/A		
12	WA	31	37
13	WA	42	46
14	Qld	142	24
15	N/A		
16	SA	51	51
17	N/A		
18	N/A		
19	Qld	56	63
20	Vic	84	46
21	Vic	57	47
22	Vic	120	24
23	N/A		
24	ACT, Vic	138	47
25	N/A		
26	N/A		
27	Vic, SA	77	64
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	WA	21	97

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	36	79
42	WA	37	77
43	SA	49	75
44	WA	51	60
45	SA	69	46
46	N/A		
47	WA	66	52
48	N/A		
49	WA	96	41
50	Qld	71	33
51	WA	56	52
52	WA	26	44
53	SA	53	52
54	WA	28	32
55	WA	43	27
56	N/A		
57	WA	83	49
58	WA	69	14
59	SA	210	30
60	Vic	110	43
61	Vic, SA	126	28
62	Vic	92	43
63	Vic	136	28
64	Vic	107	20
65	N/A		
66	Vic	186	52
67	N/A		
68	N/A		
69	N/A		

Table 3 Class 1 CSOG – Heating and cooling load limits applying to NatHERS 5.5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	N/A	11.6	58.1
5	N/A		
6	N/A	60.7	83.8
7	Qld	18	115
8	N/A	74.3	68.5
9	Qld	51	55
10	Qld	27	49
11	N/A		
12	N/A	37.3	45.8
13	N/A	64.8	46.5
14	N/A	175.8	16
15	N/A		
16	N/A	78.6	53.9
17	N/A		
18	N/A		
19	N/A	69.2	69.7
20	N/A	114.2	67.9
21	N/A	67.1	49.4
22	N/A	140	27.3
23	N/A		
24	N/A	161.1	48.1
25	N/A		
26	N/A		
27	N/A	97	62.9
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A	27.6	103

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	N/A	43.9	85.7
42	N/A	45.8	83.6
43	N/A	55.1	83.2
44	N/A	59.2	64.8
45	N/A	82.3	44.1
46	N/A		
47	N/A	94.5	58.6
48	N/A		
49	N/A	124.8	35.3
50	N/A	81.8	36.1
51	N/A	70.5	53.3
52	N/A	34.1	46.9
53	N/A	66.6	51
54	N/A	35.9	34.3
55	N/A	51.6	24.5
56	N/A		
57	N/A	100.9	44
58	N/A	76.5	17.7
59	N/A	247.4	28.5
60	N/A	127.3	41.8
61	N/A	148	21.4
62	N/A	105.2	38.3
63	N/A	154.6	22.6
64	N/A	122.5	20
65	N/A		
66	N/A	211.8	42.8
67	N/A		
68	N/A		
69	N/A		

Table 4 Class 1 SF – Heating and cooling load limits applying to NatHERS 5.5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	N/A	16.6	56.8
5	N/A		
6	N/A	64.8	91.6
7	Qld	28	112
8	N/A	81	71.5
9	Qld	50	48
10	Qld	32	47
11	N/A		
12	N/A	38.8	41.7
13	N/A	68.1	50.5
14	N/A	173.8	27.4
15	N/A		
16	N/A	82	60.5
17	N/A		
18	N/A		
19	N/A	66.8	74.2
20	N/A	124.4	85.1
21	N/A	79.8	62.1
22	N/A	150.3	33.9
23	N/A		
24	N/A	174.7	67.2
25	N/A		
26	N/A		
27	N/A	103.1	75.3
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A	34.8	105.5

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	N/A	44.5	85.5
42	N/A	44.4	83.4
43	N/A	59.7	83.1
44	N/A	61.9	65.3
45	N/A	88.3	47.2
46	N/A		
47	N/A	88.7	65.4
48	N/A		
49	N/A	126.9	44.1
50	N/A	83	44.8
51	N/A	72.5	57.4
52	N/A	35.7	48.7
53	N/A	71	56.2
54	N/A	39.8	38.3
55	N/A	56.7	30.8
56	N/A		
57	N/A	108.8	57.3
58	N/A	83.1	23.1
59	N/A	251.9	41.6
60	N/A	137.3	59.6
61	N/A	154.8	37.3
62	N/A	117.6	54.7
63	N/A	166.4	35.2
64	N/A	136.9	24.3
65	N/A		
66	N/A	226.1	69.5
67	N/A		
68	N/A		
69	N/A		

Table 5 Class 1 CSOG – Heating and cooling load limits applying to NatHERS 5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	N/A	15.3	66
5	N/A		
6	N/A	68.3	89
7	Qld	26	126
8	N/A	87.1	79.4
9	Qld	53	60
10	Qld	33	60
11	N/A		
12	N/A	41.6	51.6
13	N/A	75	53
14	N/A	213.6	18.8
15	N/A		
16	N/A	93.7	63.1
17	N/A		
18	N/A		
19	N/A	78.3	87.1
20	N/A	144.4	94.1
21	N/A	85.8	54.5
22	N/A	171.2	39.2
23	N/A		
24	N/A	198.7	57.4
25	N/A		
26	N/A		
27	N/A	116.6	73.7
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A	37.4	118.3

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	N/A	52.3	101.3
42	N/A	53.6	100.3
43	N/A	67.5	98.7
44	N/A	70.7	73.1
45	N/A	93.5	54.4
46	N/A		
47	N/A	103.2	61.6
48	N/A		
49	N/A	151	37
50	N/A	92.2	41.2
51	N/A	84.9	58.7
52	N/A	40.7	51.8
53	N/A	80.7	57.2
54	N/A	42.9	39.2
55	N/A	66	30.6
56	N/A		
57	N/A	127.3	55
58	N/A	95.3	26.2
59	N/A	287.9	41.4
60	N/A	158	50.2
61	N/A	176.7	25.7
62	N/A	130.1	49.5
63	N/A	184.9	30.5
64	N/A	150.8	27.7
65	N/A		
66	N/A	254	57.8
67	N/A		
68	N/A		
69	N/A		

Table 6 Class 1 SF – Heating and cooling load limits applying to NatHERS 5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	N/A	20.5	65.3
5	N/A		
6	N/A	77.5	104
7	Qld	34	127
8	N/A	92.3	79.3
9	Qld	55	57
10	Qld	33	47
11	N/A		
12	N/A	45.7	46.5
13	N/A	76.3	56.3
14	N/A	205.8	32.2
15	N/A		
16	N/A	94.4	69.3
17	N/A		
18	N/A		
19	N/A	79.6	83.2
20	N/A	150.9	107
21	N/A	99	77.5
22	N/A	177	51.7
23	N/A		
24	N/A	207.1	79.3
25	N/A		
26	N/A		
27	N/A	117	86.3
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A	47.3	123.3

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	N/A	51.2	99.2
42	N/A	51	98.7
43	N/A	69.1	96.8
44	N/A	70.4	73.5
45	N/A	99.7	53.5
46	N/A		
47	N/A	103.3	72.3
48	N/A		
49	N/A	143.8	50.1
50	N/A	94.6	49.6
51	N/A	81.6	65
52	N/A	41.3	53.6
53	N/A	81.5	63.6
54	N/A	44.7	40.4
55	N/A	71.1	35
56	N/A		
57	N/A	134.2	65.4
58	N/A	98.3	33.6
59	N/A	288.5	52
60	N/A	165.4	67.6
61	N/A	180.6	45
62	N/A	138.7	64.4
63	N/A	192	42.4
64	N/A	160.3	27.7
65	N/A		
66	N/A	262.4	86.9
67	N/A		
68	N/A		
69	N/A		

Table 7 Class 2 SOU and Class 4 parts – Heating and cooling load limits applying to NatHERS 6 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	9	54
5	N/A		
6	Qld	71	79
7	Qld	20	102
8	Qld, SA	68	64
9	Qld	59	43
10	Qld	21	45
11	N/A		
12	WA	40	33
13	WA	61	44
14	Qld	163	11
15	N/A		
16	SA	54	45
17	N/A		
18	N/A		
19	Qld	63	60
20	Vic	105	26
21	Vic	64	38
22	Vic	127	15
23	N/A		
24	ACT, Vic	145	33
25	N/A		
26	N/A		
27	Vic, SA	81	54
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A	N/A	N/A

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	39	81
42	WA	38	80
43	SA	50	83
44	WA	50	56
45	SA	68	43
46	N/A		
47	WA	75	42
48	N/A		
49	WA	106	29
50	Qld	78	35
51	WA	65	45
52	WA	26	34
53	SA	56	46
54	WA	34	35
55	WA	47	17
56	N/A		
57	WA	89	21
58	WA	68	9
59	N/A	N/A	N/A
60	Vic	103	49
61	Vic, SA	129	12
62	Vic	91	28
63	Vic	136	12
64	Vic	104	14
65	N/A		
66	Vic	188	30
67	N/A		
68	N/A		
69	N/A		

Table 8 Class 2 SOU and Class 4 parts – Heating and cooling load limits applying to NatHERS 5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	29	69
5	N/A		
6	Qld	108	120
7	Qld	62	126
8	Qld, SA	96	109
9	Qld	75	69
10	Qld	36	65
11	N/A		
12	WA	53	54
13	WA	82	59
14	Qld	212	24
15	N/A		
16	SA	91	80
17	N/A		
18	N/A		
19	Qld	86	97
20	Vic	146	77
21	Vic	90	61
22	Vic	169	28
23	N/A		
24	ACT, Vic	199	52
25	N/A		
26	N/A		
27	Vic, SA	113	83
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	Qld		
36	Qld		
37	N/A		
38	N/A		
39	Qld		
40	WA	116	149

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	78	102
42	WA	77	102
43	SA	102	110
44	WA	69	82
45	SA	89	72
46	N/A		
47	WA	101	62
48	N/A		
49	WA	141	44
50	Qld	103	56
51	WA	87	68
52	WA	36	47
53	SA	77	67
54	WA	46	50
55	WA	64	30
56	N/A		
57	WA	118	40
58	WA	90	21
59	N/A	N/A	N/A
60	Vic	147	50
61	Vic, SA	167	31
62	Vic	124	40
63	Vic	176	28
64	Vic	142	29
65	N/A		
66	Vic	246	53
67	N/A		
68	N/A		
69	N/A		

Table 9 Class 1 CSOG – Heating and cooling load limits applying to NatHERS 6.5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	4	50
5	N/A		
6	Qld	40	75
7	Qld	12	92
8	Qld, SA	59	52
9	Qld	37	43
10	Qld	16	39
11	N/A		
12	WA	25	36
13	WA	53	34
14	Qld	141	12
15	N/A		
16	SA	54	37
17	N/A		
18	N/A		
19	Qld	48	56
20	Vic	87	34
21	Vic	48	41
22	Vic	110	12
23	N/A		
24	ACT, Vic	129	34
25	N/A		
26	N/A		
27	Vic, SA	71	43
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	WA	20	86

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	20	73
42	WA	19	71
43	SA	29	68
44	WA	45	39
45	SA	66	32
46	N/A		
47	WA	78	37
48	N/A		
49	WA	103	27
50	Qld	66	28
51	WA	57	41
52	WA	26	33
53	SA	51	38
54	WA	29	26
55	WA	40	15
56	N/A		
57	WA	80	28
58	WA	59	6
59	SA	195	13
60	Vic	95	27
61	Vic, SA	116	15
62	Vic	80	22
63	Vic	116	11
64	Vic	96	10
65	N/A		
66	Vic	169	21
67	N/A		
68	N/A		
69	N/A		

Table10 Class 1 SF – Heating and cooling load limits applying to NatHERS 6.5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	9	50
5	N/A		
6	Qld	48	72
7	Qld	17	93
8	Qld, SA	57	58
9	Qld	37	38
10	Qld	21	38
11	N/A		
12	WA	26	33
13	WA	34	41
14	Qld	125	19
15	N/A		
16	SA	43	46
17	N/A		
18	N/A		
19	Qld	49	57
20	Vic	72	37
21	Vic	47	39
22	Vic	105	18
23	N/A		
24	ACT, Vic	123	41
25	N/A		
26	N/A		
27	Vic, SA	69	58
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	WA	18	91

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	32	72
42	WA	32	68
43	SA	44	67
44	WA	46	49
45	SA	62	38
46	N/A		
47	WA	56	45
48	N/A		
49	WA	87	38
50	Qld	65	31
51	WA	51	48
52	WA	22	40
53	SA	45	47
54	WA	23	34
55	WA	36	24
56	N/A		
57	WA	70	44
58	WA	57	9
59	SA	191	26
60	Vic	92	36
61	Vic, SA	110	23
62	Vic	79	37
63	Vic	116	23
64	Vic	94	18
65	N/A		
66	Vic	163	43
67	N/A		
68	N/A		
69	N/A		

Table 11 Class 2 SOU and Class 4 parts – Heating and cooling load limits applying to NatHERS 6.5 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	6	49
5	N/A		
6	Qld	60	68
7	Qld	11	92
8	Qld, SA	59	61
9	Qld	53	35
10	Qld	18	40
11	N/A		
12	WA	35	26
13	WA	53	38
14	Qld	148	8
15	N/A		
16	SA	44	36
17	N/A		
18	N/A		
19	Qld	55	49
20	Vic	93	17
21	Vic	48	32
22	Vic	114	12
23	N/A		
24	ACT, Vic	130	28
25	N/A		
26	N/A		
27	Vic, SA	72	47
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A		

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	30	74
42	WA	28	72
43	SA	38	74
44	WA	44	48
45	SA	61	36
46	N/A		
47	WA	66	37
48	N/A		
49	WA	96	25
50	Qld	71	30
51	WA	58	39
52	WA	23	29
53	SA	49	39
54	WA	29	29
55	WA	41	14
56	N/A		
57	WA	79	17
58	WA	59	6
59	N/A		
60	Vic	88	48
61	Vic, SA	115	8
62	Vic	82	25
63	Vic	121	8
64	Vic	93	11
65	N/A		
66	Vic	168	23
67	N/A		
68	N/A		
69	N/A		

Table 12 Class 1 CSOG – Heating and cooling load limits applying to NatHERS 7.0 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	3	46
5	N/A		
6	Qld	34	71
7	Qld	9	84
8	Qld, SA	52	45
9	Qld	34	39
10	Qld	13	36
11	N/A		
12	WA	21	32
13	WA	48	30
14	Qld	127	10
15	N/A		
16	SA	46	32
17	N/A		
18	N/A		
19	Qld	42	50
20	Vic	77	26
21	Vic	41	38
22	Vic	99	9
23	N/A		
24	ACT, Vic	117	30
25	N/A		
26	N/A		
27	Vic, SA	62	36
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	WA	18	81

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	15	67
42	WA	15	65
43	SA	22	61
44	WA	40	33
45	SA	60	28
46	N/A		
47	WA	71	31
48	N/A		
49	WA	93	25
50	Qld	61	25
51	WA	51	37
52	WA	23	29
53	SA	45	34
54	WA	26	23
55	WA	35	13
56	N/A		
57	WA	71	23
58	WA	51	4
59	SA	177	9
60	Vic	82	22
61	Vic, SA	104	12
62	Vic	70	17
63	Vic	100	8
64	Vic	86	7
65	N/A		
66	Vic	152	16
67	N/A		
68	N/A		
69	N/A		

Table13 Class 1 SF – Heating and cooling load limits applying to NatHERS 7.0 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	7	47
5	N/A		
6	Qld	42	64
7	Qld	13	85
8	Qld, SA	48	53
9	Qld	33	34
10	Qld	18	37
11	N/A		
12	WA	22	30
13	WA	26	38
14	Qld	110	17
15	N/A		
16	SA	34	41
17	N/A		
18	N/A		
19	Qld	43	52
20	Vic	60	28
21	Vic	38	32
22	Vic	91	14
23	N/A		
24	ACT, Vic	108	35
25	N/A		
26	N/A		
27	Vic, SA	59	52
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	WA	15	86

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	28	65
42	WA	29	63
43	SA	38	60
44	WA	40	43
45	SA	54	35
46	N/A		
47	WA	46	39
48	N/A		
49	WA	76	36
50	Qld	60	27
51	WA	45	44
52	WA	18	37
53	SA	38	44
54	WA	18	32
55	WA	29	21
56	N/A		
57	WA	59	40
58	WA	49	6
59	SA	171	21
60	Vic	77	30
61	Vic, SA	95	19
62	Vic	67	32
63	Vic	99	19
64	Vic	82	16
65	N/A		
66	Vic	144	35
67	N/A		
68	N/A		
69	N/A		

Table 14 Class 2 SOU and Class 4 parts – Heating and cooling load limits applying to NatHERS 7.0 stars

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
1	N/A		
2	N/A		
3	N/A		
4	WA	4	45
5	N/A		
6	Qld	51	57
7	Qld	7	84
8	Qld, SA	51	50
9	Qld	49	30
10	Qld	15	35
11	N/A		
12	WA	31	21
13	WA	46	33
14	Qld	135	6
15	N/A		
16	SA	36	29
17	N/A		
18	N/A		
19	Qld	49	41
20	Vic	83	12
21	Vic	43	27
22	Vic	102	10
23	N/A		
24	ACT, Vic	118	24
25	N/A		
26	N/A		
27	Vic, SA	64	40
28	N/A		
29	N/A		
30	N/A		
31	N/A		
32	N/A		
33	N/A		
34	N/A		
35	N/A		
36	N/A		
37	N/A		
38	N/A		
39	N/A		
40	N/A		

NatHERS climate zone	Applicable State and/or Territory	Heating load limit (MJ/m2.annum)	Cooling load limit (MJ/m2.annum)
41	WA	23	67
42	WA	22	66
43	SA	28	66
44	WA	39	41
45	SA	55	30
46	N/A		
47	WA	57	31
48	N/A		
49	WA	86	21
50	Qld	64	26
51	WA	52	33
52	WA	20	25
53	SA	43	33
54	WA	24	24
55	WA	36	11
56	N/A		
57	WA	71	13
58	WA	52	4
59	N/A		
60	Vic	75	48
61	Vic, SA	104	6
62	Vic	73	22
63	Vic	107	5
64	Vic	84	9
65	N/A		
66	Vic	152	19
67	N/A		
68	N/A		
69	N/A		