Eurovent Standards for chillers JP1

The Performance Requirements of the National Construction Code (NCC) can be met using either a Performance Solution, a Deemed-to-Satisfy (DTS) Solution, or a combination of both. The following demonstrates the performance-based design process, aligning with the ABCB's Performance Solution Process guidance document.

Scenario

An air-cooled chiller, tested to European standards has been selected for a Class 5 office building. This chiller (621 kW capacity) has been certified and tested to the Eurovent standards EN 14511/14825. A Performance Solution is needed to show that the performance of the chiller under the Eurovent standards is equivalent or better than that required under the Air-Conditioning, Heating and Refrigeration Institute (AHRI) standard referenced in the DTS Provisions.

Prepare a performance-based design brief

What are the design objectives?

To deliver an efficient building using a Eurovent certified chiller and minimise the need to retest the chiller to the standard referenced in the DTS Provisions.

Who should be consulted?

- The design team and the Appropriate Authority.
- The mechanical designer should lead the consultation process, as the Performance Solution is focused on an item of heating, ventilation and air-conditioning (HVAC) plant.

What is the basis of the Performance Solution?

- The chiller has been tested and certified under the Eurovent standards EN 14511/14825.
- The level of efficiency certified under the Eurovent standards needs to meet or exceed the level of efficiency specified in the DTS Provision J5.10 of NCC Volume One, which uses the AHRI standards.

What evidence is proposed?

- A current certification diploma provided by the chiller manufacturer certifying the Eurovent testing results.
- An expert's report demonstrating the approach used and that the Eurovent results are equal or superior to the AHRI performance levels in the DTS Provisions.

Which DTS Provision is applicable?

Chiller efficiency is covered in J5.10 of NCC Volume One. It specifies two options for the EER i.e. a coefficient of performance (COP) and integrated part load value (IPLV). Both of these parameters are tested to AHRI 551/591.

Which Performance Requirement is applicable?

JP1 in NCC Volume One is the applicable Performance Requirement. This solution only satisfies part of JP1, not its entirety.

Note: for brevity, for brevity, the applicable Performance Requirements and DTS Provisions have been limited. When determining which Performance Requirements and DTS Provisions are applicable, consideration should be made to the latest edition of the NCC. This solution may also impact other Performance Requirements and DTS Provisions and must be considered in accordance with Part A2 of NCC 2019.

Carry out analysis

Which Assessment Methods are the most suitable and where can they be found?

Assessment Methods are listed in A2.2 of Part A2 and state that any Assessment Method or combination of them may be used to determine that a solution complies with the Performance Requirements. In this scenario, comparison with the DTS Provisions will be used as the Assessment Method.

What analysis, modelling or testing is used?

The Council of Australian Governments (COAG) Energy Council's Equipment Energy Efficiency (E3) program, which regulates the Minimum Energy Performance Standards (MEPS) for chillers has determined equivalency levels between the AHRI and Eurovent testing methods. Tables 1 and 2, based on the proposed MEPS levels for 2021, demonstrate the minimum DTS requirements using AHRI 551/591 (in J5.10) for COP and IPLV and the equivalent levels of performance achieved if tested under the Eurovent standards EN 14511/14825. The rows highlighted in blue and green show the chiller used in this scenario.

Table 1: Equivalent Levels of Performance (Option 1) (includes extracts from Table J5.10a in NCC Volume One)

Chiller Type	Capacity	AHRI COP	Eurovent EER	AHRI IPLV	Eurovent SEER
Air-cooled	≤528 kWr	2.985	2.931	4.048	3.387
Air-cooled	**>528 kWr**	**2.985**	**2.931**	**4.137**	**3.462**
Water-cooled, Positive Displacement	≤264 kWr	4.694	4.591	5.867	4.411
Water-cooled, Positive Displacement	>264 kWr but ≤528 kWr	4.889	4.781	6.286	4.726
Water-cooled, Positive Displacement	>528 kWr but ≤1055 kWr	5.334	5.217	6.519	5.034
Water-cooled, Positive Displacement	>1055 kWr but ≤2110 kWr	5.800	5.672	6.770	5.228
Water-cooled, Positive Displacement	>2110 kWr	6.286	6.148	7.041	5.437
Water-cooled, Centrifugal	≤528 kWr	5.771	5.644	6.401	4.813
Water-cooled, Centrifugal	>528 kWr but ≤1055 kWr	5.771	5.644	6.519	5.034
Water-cooled, Centrifugal	>1055 kWr but ≤1407 kWr	6.286	6.148	6.770	5.228
Water-cooled, Centrifugal	>1407 kWr	6.286	6.148	7.041	5.437

Table 2: Equivalent Levels of Performance (Option 2) (includes extracts from Table J5.10a in NCC Volume)

Chiller Type	Capacity	AHRI COP	Eurovent EER	AHRI IPLV	Eurovent SEER
Air-cooled	≤528 kWr	2.866	2.814	4.669	3.907
Air-cooled	**>528 kWr**	**2.866**	**2.814**	**4.758**	**3.982**
Water-cooled, Positive Displacement	≤264 kWr	4.513	4.414	7.041	5.294
Water-cooled, Positive Displacement	>264 kWr but ≤528 kWr	4.694	4.591	7.184	5.402
Water-cooled, Positive Displacement	>528 kWr but ≤1055 kWr	5.177	5.063	8.001	6.178
Water-cooled, Positive Displacement	>1055 kWr but ≤2110 kWr	5.633	5.509	8.586	6.630
Water-cooled, Positive Displacement	>2110 kWr	6.018	5.886	9.264	7.154
Water-cooled, Centrifugal	≤528 kWr	5.065	4.954	8.001	6.016
Water-cooled, Centrifugal	>528 kWr but ≤1055 kWr	5.544	5.422	8.001	6.178
Water-cooled, Centrifugal	>1055 kWr but ≤1407 kWr	5.917	5.787	9.027	6.971
Water-cooled, Centrifugal	>1407 kWr	6.018	5.886	9.264	7.154

The chiller chosen is air-cooled and has a 621 kW capacity, an EER of 3.12 and SEER of 4.38. The black highlighted cells in Tables 1 and 2 indicate the two options available through the DTS Provisions and the minimum requirements. Either option can be followed, depending on if the chiller chosen will be operating primarily at full load (COP/EER) or part load (IPLV/SEER). It can be seen through comparison with the Eurovent equivalent values in the gold highlighted cells that this chiller has a higher level of performance than the minimum required under either option 1 or option 2.

Evaluate results

The chiller selected for this application has a higher level of efficiency than both option 1 and option 2 in the DTS Provisions for EER and SEER. This means that the chiller will use less energy than would have been required by a DTS Solution. As such, it is suitable as a Performance Solution through the comparison with the DTS Provisions approach of clause A2.2(2)(d).

Prepare a final report

What should be in the final submission?

The final report includes:

- An overview of the Performance-Based Design Brief, outlining:
  > the approach used for the Performance Solution
  > how a comparison to the DTS Provisions was undertaken and the result
  > the reference to the relevant NCC Assessment Method, Performance Requirements and DTS Provisions
- A Eurovent diploma of certification for the chiller
- A statement from the stakeholder group acknowledging acceptance of the Performance Solution.