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IEQ

## 6.5 THERMAL COMFORT

### IEQ 14 THERMAL COMFORT IN NATURALLY VENTILATED PREMISES

#### EXCLUSIONS

Buildings that are not designed to utilise natural ventilation.

#### OBJECTIVE

Promote the application of measures that reduce elevated temperatures caused by external heat gains, and ensure installed air-conditioning units can provide adequate control of indoor temperature.

#### CREDITS ATTAINABLE

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#### PREREQUISITES

None.

#### CREDIT REQUIREMENT

a) Performance with natural ventilation

1 credit for demonstrating indoor operative temperatures in occupied/habitable rooms meet the 80% acceptability limits.

Alternatively,

1 credit for demonstrating the predicted Mean Vote (PMV) in occupied/habitable rooms is between -1 and +1.

Alternatively,

1 credit for demonstrating that, the thermal performance, and the internal wind speeds, of the occupied/habitable rooms fall within the 80% acceptability range for the tropical climate conditions of Hong Kong.

b) Performance with air-conditioning

1 credit for sustaining the air temperature at the design value within  $\pm 1.5^{\circ}\text{C}$  when the air-conditioning unit is operating at steady state under normal occupied periods.

#### ASSESSMENT

a) Performance with natural ventilation

The assessment establishes the extent to which the design of the building envelope can mitigate the effects of external heat gains. Based on the output from a suitable thermal simulation model of the building the predicted indoor operative temperature shall be compared with the criteria given in ASHRAE 55 [1] under the 'Optional Method for Determining Acceptable Thermal Conditions in Naturally Conditioned Spaces'.

Assessment may be confined to the scenarios with the highest mean monthly temperature of the hottest month or higher radiation heat gain of whichever is higher, i.e., for those normally occupied areas of the building most susceptible to external heat gains and/or which do not benefit from the prevailing climatic conditions.

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The spaces in question must be equipped with operable windows that can be readily opened and adjusted by the occupants. Mechanical cooling for the space shall not be provided, although mechanical ventilation with unconditioned air may be utilised.

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The thermal analysis shall be undertaken using dynamic thermal modelling software. The thermal performance within the occupied or habitable space of each type of premises most affected by solar gains shall be determined. The modelling shall include full annual simulation using standard Hong Kong weather data. The modelling will include the effect of installed solar control features, e.g. glazing, internal or external shading components, fabric and infiltration specifications, and site obstructions. The modelling needs not include any internal gains, i.e.,

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1 American Society of Heating, Refrigeration and Air-conditioning Engineers. ASHRAE 55-2004: Thermal Environmental Conditions for Human Occupancy. Atlanta 2004.

simulations for unoccupied premises are required.

Alternatively, compliance may be demonstrated under appropriate summer and winter conditions through the measurement of temperature in suitable locations in a sample of premises most exposed to external heat gains.

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The Client shall provide evidence in the form of a report prepared by a suitably qualified person detailing any means used to control the external (solar) heat gains, the specification and details of the thermal simulation software used in the analysis, and the results of the simulations.

Where compliance is demonstrated by measurements the details of measuring equipment, sampling locations, sampling time, time of measurements, external temperature and prevailing weather conditions shall be provided.

Where it can be demonstrated that the predicted indoor temperature lies within the 80% acceptability limits given in ASHRAE 55-2004 a credit shall be awarded.

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Alternately, where it can be demonstrated that the Predicted Mean Vote (PMV) in occupied/ habitable rooms is between -1 and +1, a credit shall be awarded.

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#### b) Performance with air-conditioning

The measurement locations shall include at least one representative sample of each type of premises (occupied spaces) as defined by the type of HVAC system used, design occupancy density, nature of usage, zoning, etc. The measurements shall be undertaken in a normal occupied period. The sensors used in the measurement survey shall have an accuracy that complies with ISO 7726 [2] or equivalent. To earn credit the results shall demonstrate compliance with the prescribed design criteria within the prescribed limits, for a minimum of 90% of the prescribed locations.

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## BACKGROUND

Thermal comfort standards such as ISO 7730 [3] and ASHRAE 55 establish relatively tight limits on recommended indoor thermal environments, and do not distinguish between what would be considered thermally acceptable in buildings conditioned with natural ventilation. Derived from laboratory experiments using a thermal-balance model of the human body these standards have attempted to provide an objective criterion for thermal comfort, specifying combinations of personal and environmental factors that will produce interior thermal environments acceptable to at least 80% of a building's occupants. The heat-balance models, on which the standards are based, were developed in tightly controlled conditions. The people involved were considered passive subjects of climate change in artificial settings, and little consideration was given to the broad ways they might naturally adapt to a more wide ranging thermal environments in realistic settings.

Field studies and research has demonstrated that occupants of buildings with centralised HVAC systems become finely tuned to the very narrow range of indoor temperatures provided, developing high expectations for homogeneity and cool temperatures, and soon became critical if thermal conditions do not match these expectations [4,5]. In contrast, occupants of naturally ventilated buildings are more tolerant of a wider range of

- 2 International Standard Organization. ISO 7726, Ergonomics of the thermal environment — Instruments for measuring physical quantities. 1998.
- 3 International Standard Organization. ISO 7730. Moderate thermal environments – Determination of the PMV and PPD indices and specification of the conditions for thermal comfort.
- 4 de Dear R, Brager G S, Reardon J, Nicol F et al. Developing an adaptive model of thermal comfort and preference/ Discussion. ASHRAE Transactions. Vol. 104. 1998. pp 145-167.
- 5 Brager G S, de Dear R. A Standard for Natural Ventilation. ASHRAE Journal. October 2000. pp 21-28.

**Q11. IEQ 7, For BEAM Plus New Buildings Version 1.1 and 1.2, is it necessary to demonstrate that the measurement is taken at background mode?**

**Q12. IEQ 8 (second Bonus credit), for BEAM Plus Existing Building Version 2.0 Comprehensive Scheme, whether the “Indoor Air Quality Certification Scheme for Office and Public Place” certificate should cover the whole development or part of the development:**

**Q13. IEQ 10, For BEAM Plus New Buildings Version 1.1 and 1.2, should domestic kitchen be considered as normally occupied premises?**

**Q14. IEQ 11a, for BEAM Plus New Buildings Version 1.1 & 1.2, if the Applicant does not provide any ventilation equipment for kitchen and toilet areas, should these areas be included in the assessment?**

**Q15. IEQ 11a, For BEAM Plus New Buildings Version 1.1 and 1.2, should T&C records of window fan/propeller fan without air duct required to be submitted in the Final Assessment?**

**Q16. IEQ 11b, For BEAM Plus New Buildings Version 1.1 & 1.2, is clubhouse applicable to this credit?**

**Q17. IEQ 12, For BEAM Plus New Buildings Version 1.1 and 1.2, can lift lobby served by firemen’s lift be exempted from the assessment?**

**Q18. IEQ 12a, For BEAM Plus New Buildings Version 1.1 and 1.2, is enclosed common areas ventilated via “fresh air louver + EAF” / “transfer air duct” comply with BEAM Plus requirement?**

**Q19. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2. what should be the duration of temperature measurement?**

The measurement should be undertaken on an 8-hour basis during normally occupied period (i.e. from 8am to 9pm in the living room and from 9pm to 8am in the bedroom for residential development). However, where it is not practicable to take 8-hour continuous measurement, a surrogate measurement (i.e. an intermittent measurement strategy based on the average of half-hour measurements conducted at four time slots) is also considered acceptable.

(Released on 29 November 2019)

**Q20. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, how should the representative sampling points be selected?**

**Q21. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, can T&C records of split type A/C for residential portion be accepted as evidence to demonstrate the performance of the air-conditioning units?**

**Q22. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, is it necessary for an SQP to endorse the measurement records?**

**Q23. What features can be considered as glare control under IEQ 15 in BEAM Plus Version 1.1?**

**Q24. IEQ 15, For BEAM Plus NB V1.1 and 1.2, there are a number of methodologies in the computation of the average daylight factor from various software. Will it be acceptable if the output provides the average daylight factor for the entire area of a room?**

**Q25. IEQ 16&17, For BEAM Plus New Buildings Version 1.1 and 1.2, how should the representative sampling points be selected and what is the percentage of compliance of the sampling points in order to achieve the credit?**

**Q26. IEQ 16&17, For BEAM Plus New Buildings Version 1.1 and 1.2, should decorative lighting be assessed?**

**Q27. IEQ 18, 19, 20 & 21, For BEAM Plus New Buildings Version 1.1 and 1.2, what is the definition of “suitably qualified person” (SQP)?**

**Q28. IEQ 18, For BEAM Plus New Buildings Version 1.1 and 1.2, how should the representative sampling points be selected?**

**Q29. IEQ 19, For BEAM Plus New Buildings Version 1.1 and 1.2, how should the representative sampling points be selected?**

Q11. IEQ 7, For BEAM Plus New Buildings Version 1.1 and 1.2, is it necessary to demonstrate that the measurement is taken at background mode?

Q12. IEQ 8 (second Bonus credit), for BEAM Plus Existing Building Version 2.0 Comprehensive Scheme, whether the “Indoor Air Quality Certification Scheme for Office and Public Place” certificate should cover the whole development or part of the development:

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Q15. IEQ 11a, For BEAM Plus New Buildings Version 1.1 and 1.2, should T&C records of window fan/propeller fan without air duct required to be submitted in the Final Assessment?

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**Q20. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, how should the representative sampling points be selected?**

The measurement locations should include at least one representative sample from each combination of the following parameters-

- a) type of premises/room usage,
- b) room occupancy density and
- c) type of HVAC system (e.g. window type, split type and VRV type) irrespective of cooling capacity.

(Released on 29 November 2019)

Q21. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, can T&C records of split type A/C for residential portion be accepted as evidence to demonstrate the performance of the air-conditioning units?

Q22. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, is it necessary for an SQP to endorse the measurement records?

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Q24. IEQ 15, For BEAM Plus NB V1.1 and 1.2, there are a number of methodologies in the computation of the average daylight factor from various software. Will it be acceptable if the output provides the average daylight factor for the entire area of a room?

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Q21. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, can T&C records of split type A/C for residential portion be accepted as evidence to demonstrate the performance of the air-conditioning units?

No. A proper measurement for room temperature showing the variation of temperature profile should be conducted.

(Released on 29 November 2019)

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Q30. IEQ 19, For BEAM Plus New Buildings Version 1.1 and 1.2, in normal credit, is impact noise isolation (IIC) between floors required for Office, Hotel and Residential premises?

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**Q22. IEQ 14b, For BEAM Plus New Buildings Version 1.1 and 1.2, is it necessary for an SQP to endorse the measurement records?**

No. However, the submission should demonstrate that the devices used for measurement have been properly calibrated and valid calibration certificates (e.g. accredited by Hong Kong Laboratory Accreditation Scheme (HOKLAS) or under its Mutual Recognition Arrangement Partners) should be provided.

(Released on 29 November 2019)

Q23. What features can be considered as glare control under IEQ 15 in BEAM Plus Version 1.1?

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Circular Letter No.: 2020.168

Issue Date: 5 June 2020

Application: BEAM Plus NB Version 1.1 and 1.2

Effective Date: 5 June 2020

### **Updated Exclusion Clauses for IEQ Credits**

1. **Technical Circular Letter No. 2016.134 dated 09 August 2016 will be withdrawn on the effective date.**
2. This Circular Letter clarifies the exclusion clause for the following credits:

Credits	New Exclusions
IEQ P1 IEQ 9	Residential premises, or Premises without any fresh air provision <sup>1</sup> .
IEQ 3	Residential premises, or Premises without any provision of air-conditioning equipment.
IEQ 5	Residential premises, or Premises without any fresh air provision <sup>1</sup> and HVAC system.
IEQ 6	Residential premises, or Premises without any fresh air provision <sup>1</sup> .
IEQ 7a IEQ 7b	Residential premises without any interior decoration, or Premises without any fresh air provision <sup>1</sup> and interior decoration.
IEQ 10	Premises with fresh air provision <sup>1</sup> .
IEQ 11b	Residential premises, or Premises without any future tenant (for example, single owner occupier premises).
IEQ 12	Premises without any enclosed common area in the main circulation route.
IEQ 13a	Normally occupied premises <sup>2</sup> without any air-conditioning equipment installed and provided by the project proponent, or without any fresh air provision <sup>1</sup> .
IEQ 13b	Normally occupied premises <sup>2</sup> without any installation of air diffuser in the air-conditioning system.
IEQ 14a	Normally occupied premises <sup>2</sup> with fresh air provision <sup>1</sup> .
IEQ 14b	Normally occupied premises <sup>2</sup> with fresh air provision <sup>1</sup> , or without any air-conditioning equipment installed and provided by the project proponent.

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Ir SK Ho  
Chairperson of Standards Sub-committee

<sup>1</sup> Fresh air provision means any fresh air equipment such as PAU, AHU, FAU, FAP, FAF, etc.; and/or premises with fresh air louvers, etc.

<sup>2</sup> Normally occupied premises are enclosed spaces / areas where people normally stay there for more than 1 hour per person per day on average.