Guideline on Single Zone Cooling in Dwelling Units

Version 1.0a March 14, 2025

The BC Building Code (BCBC)-2024 introduced a maximum design temperature limit of 26°C for a minimum of a single living space in each dwelling unit. In April 2024, the Province of BC's Building's Safety and Standards Branch (BSSB) released Information Bulletin No. B24-08 that provides information on the new provisions in the BCBC 2024 related to minimizing the risks to health and safety due to overheating in dwelling units. Although the BSSB bulletin provided general information on requirements, and strategies with mechanical cooling systems as well as some passive design measures, it did not provide the necessary depth on the technical considerations to meet the BCBC 2024 requirements.

To address these concerns, HVAC Designers of Canada (HVAC DC) and the Thermal Environmental Comfort Association (TECA) together with stakeholders from the home building sector have developed a Guideline on Single Zone Cooling in Dwelling Units.

We thank the following individuals and organizations for their valuable contribution to the development of this Guideline.

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1. SCOPE

1.1. Good Practice: This Document is intended as a Good Practice Guideline. It is intended to be voluntarily adopted by users and is not intended to be a document which defines code-compliance.

1.2. Terminology: Within this document statements are prefaced with the term *should* as well as the term *shall*. Where *should* is used, the statement is intended to be a recommendation that should be followed if possible, however failing to follow the recommendation does not invalidate this guideline. Where *shall* is used the statement is intended to be a requirement within the context of this guideline, that is to say, in order to preserve the integrity of the calculation procedure, the statement must be followed. The use of the word *shall* is not intended to mean that the statement is a requirement outside of its use within this guideline.

1.3. Capacity Determination: The Guideline is intended to determine the required capacity of a cooling system such that the minimum requirements of the BCBC 2024 sentences 9.33.2.1.(2); 9.33.3.1.(2) and 9.33.5.1.(1) are satisfied.

1.4. Building Class Limitation: The Guideline is limited to Residential Dwelling units within the Scope of Part 9 of the BCBC.

1.5. Whole-House Cooling: The guideline does not apply to dwelling units where a cooling system provides cooling for the whole dwelling unit in accordance with the CSA F280 Standard. In this instance, the requirements of this Guideline are considered to be satisfied.

2. TECHNICAL REQUIREMENTS

2.1. Design Temperatures

2.1.1. The Design temperature of the Cooling Zone shall be 24°C.

2.1.2. Outdoor Design Temperature:

(1) Except as permitted by 2.1.2.(2) the Outdoor Design temperature (Toc) shall be the outside summer design temperatures determined from Appendix C of the BCBC and shall be those listed for the July 2.5% dry bulb values**.**

(2) The Outdoor Design temperature (Toc) may be set at a higher temperature than the temperature determined according to 2.1.2.(1) by the Authority Having Jurisdiction in the location where the home is to be built or by the person carrying out the Cooling Capacity Calculation.

2.1.3. The Design Temperature of Adjacent Unconditioned spaces (T_{ca}) shall be the same as the outdoor design temperature determined according to clause 2.1.2.

2.2 Cooling Zone Identification

2.2.1 The Cooling Zone may be a single room or a group of rooms within a dwelling unit.

2.2.2 When reference drawings are produced as a companion to the calculation, the designated room or rooms shall be designated as the “Cooling Zone”

2.2.3 The selected room-or rooms comprising the cooling zone shall be identified in the calculation result documents by the name designated on the Architectural/Design drawings upon which the calculation is based.

2.2.4 The cooling zone should have the following attributes:

(1) be equipped with doors or other closures to separate the cooling zone from the outdoors and other rooms or spaces within the dwelling unit. In the case where there are no doors or closures between the designated cooling zone and adjacent spaces, the adjacent spaces should be included in the cooling capacity, and

(2) have a minimum area of at least 48 ft^2 (4.5m^2) for each occupant based on the design number of occupants calculated according to sentence 2.3.1., and

(3) have a minimum of 1 standard electrical wall outlet and have all of the other electrical services required by the BCBC and the Canadian Electrical Code, and

(4) be equipped with provision for ventilation by:

i. exhaust from the zone to outside,
ii. supply from the outside
iii. both supply from and exhaust to the outside
iv. supply from a central air handling system,
v. return to a central air handling system, or
vi. both supply from and return to a central air handling system

2.3 OCCUPANCY

2.3.1 The design number of occupants shall be equal to the number of bedrooms plus one.

2.3.2 Ventilation Air flow rate:

(1) In a home without a central air handling system, the ventilation airflow rate for the purposes of calculating heat gain shall be assumed to be 3.5 L/s (7.5 cfm) per person based on the occupancy determined according to sentence 2.3.1.

(2) In a home with a central air handling system the ventilation airflow rate for the purposes of calculating heat gain shall the greater of:

vii. 3.5 L/s (7.5 cfm) per person, or
viii. the estimated air flow to or from the cooling zone due the operation of a central air handling system determined according to 2.3.2.(3).

(3) If a central air handling system serves the cooling zone, the airflow to or from the zone shall be estimated to be the greater of :

i. the greater of the design supply or return from the zone with the air handler on circulation speed, or
ii. 2.5 L/s/m^2 (0.5 cfm/ft^2)

2.4 DESIGN TEMPERATURE DIFFERENCES

2.4.1 Design temperature difference to outdoors:

The design temperature difference between the cooling zone and the outdoors shall be calculated as follows:

$CZODTD_c = T_{oc} - CZT_{ic}$

Where

$CZODTD_c$ = Cooling Zone to outside design temperature difference, °C

T_{oc} = Outdoor design temperature as specified in Clause 2.1.2. °C

CZT_{ic} = Cooling zone design temperature as specified in Clause 2.1.1. °C

And

If $CZADTD_c$ is less than zero then it shall be set to zero

2.4.2 Design temperature difference to adjacent spaces:

The design temperature difference between the cooling zone and adjacent unconditioned spaces shall be calculated as follows:

$CZADTD_c = AT_{oc} - CZT_{ic}$

Where

$CZADTD_c$ = Cooling zone to adjacent space design temperature difference, °C

AT_{oc} = Adjacent unconditioned space design temperature as specified in sentence 2.1.3. °C

CZT_{ic} = Cooling zone design temperature as specified in sentence 2.1.1. °C

And

If $CZADTD_c$ is less than zero then it shall be set to zero.

2.5 HEAT GAIN

2.5.1 Heat gain through Opaque Building assembles between the cooling zone and the outside of the building (HG_{cop}) shall be calculated according to CSA F280 clause 6.2.1. except that the Design temperature Difference (DTD) shall be the $CZODTD_c$ determined according to clause 2.4.1. above.

2.5.2 Heat Gain through transparent and translucent building assemblies between the cooling zone and the outside (HG_{cot}) shall be calculated according to CSA F280-12 clause 6.2.2.1. and 6.2.2.2. except that the Design Temperature Difference (DTD) shall be the $CZODTD_c$ determined according to clause 2.4.1. above.

2.5.3 Heat Gain through opaque building assembles between the cooling zone and adjacent unconditioned spaces (HG_{caop})shall be calculated according to CSA F280-12 clause 6.2.1. except that the solar correction shall be set to zero and DTD shall be the $CZADTD_c$ determined according to clause 2.4.2. above.

2.5.4 Heat Gain though transparent and translucent building assemblies between the cooling zone and adjacent unconditioned spaces (HG_{cat}) shall be determined according to CSA F280-12 clause 6.2.2.1. except that the Design Temperature Difference (DTD) shall be the $CZADTD_c$ determined according to clause 2.4.2. above and the value for “Solar” shall be set to zero.

2.5.5 Total Conductive heat Gain:

The total conductive component of heat gain for the cooling zone shall be calculated as follows:

HG_{ccz} = sum of HG_{cop} + sum of HG_{cot} + sum of HG_{caop} + sum of HG_{cat} for all building assemblies in the cooling zone that separate the zone from the outside and adjacent unconditioned spaces.

Where

HG_{ccz} = total conductive heat gain for the cooling zone, W

HG_{cop} = conductive heat gain through opaque building assemblies between the cooling zone and the outside determined according to sentence 2.5.1., W.

HG_{cot} = conductive heat gain through transparent or translucent building assemblies between the cooling zone and the outside determined according to 2.5.2., W.

HG_{coap} = conductive heat gain through opaque building assemblies between the cooling zone and adjacent unconditioned spaces determined according to 2.5.3., W.

HG_{cat} = conductive heat gain through transparent or translucent building assemblies between the cooling zone and adjacent unconditioned spaces determined according to sentence 2.5.4., W.

2.5.6 Sensible Heat Gain due to occupants:

The sensible heat gain due to occupants, (HG_{spcz}) shall be added to the Total Sensible Heat Gain for the Cooling Zone at a rate of 70 W per person and the number of occupants shall be according to clause 2.3.1

2.5.7 Sensible Heat Gain due lights, Appliances and Electrical Plug Loads:

A sensible heat gain value, (HG_{laecz}) shall be added to the total sensible heat gain for the cooling zone to account for appliance use and shall be the lesser of:

1) 800 W, or
2) 4 W/m^2 based on the area of the dwelling unit in which the Cooling Zone is located.

2.5.8 Sensible Heat Gain due to air Leakage:

An air leakage component of sensible heat gain for the cooling zone shall be calculated as follows:

$HG_{salcz} = LR_{ccz} \times VO_{cz}/3.6 \times CZODTDc \times 1.2$

Where

LR_{ccz} = 0.3 Air Changes per Hour

VO_{cz} = volume of the cooling zone measured on the inside dimensions, m^3

$CZODTD_c$ = Design temperature difference calculated according to clause 2.4.1.

HG_{salcz} = sensible heat gain due to air leakage for the cooling zone, W

OR

$HG_{salcz} = HG_{salb}$ = sensible heat gain due to air leakage for the building determined according to F280-12 clause 6.2.6., W

2.5.9. Sensible Heat Gain due to Ventilation

A ventilation component of sensible heat gain for the cooling zone shall be calculated as follows:

$HG_{svcz} = VCcz \times CZODTD_c \times 1.2 \times (1\text{-}ATRE)$

Where

HG_{svcz} = sensible heat gain due to ventilation for the cooling zone, W

ATRE = adjusted total recovery efficiency of the HRV/ERV, expressed as a fraction, or zero if there is no ATRE reported or if there is no heat recovery.

CZODTDc = Design temperature difference calculated according to clause 2.4.1. °C

VC_{cz} = the ventilation airflow rate determined according to clause 2.3.2.

2.6 Total Sensible Heat Gain

The total sensible heat gain for the cooling zone shall be calculated as follows:

$HG_{scz} = HG_{ccz} + HG_{spcz} + HG_{laecz} + Hg_{salcz} + HG_{svcz}$

Where

HG_{ccz} = Total Conductive Heat gain for the zone determined according to clause 2.5.5., W.

HG_{spcz} = sensible heat gain due to occupants determined according to sentence 2.5.6., W.

HG_{laecz} = sensible heat gain due to lights, appliances, and electrical plug loads determined according to sentence 2.5.7., W,

Hg_{salcz} = sensible heat gain due to air leakage determined according to clause 2.5.8., W

HG_{svcz} = sensible heat gain due to ventilation determined according to clause 2.5.9., W

HG_{scz} = total sensible heat gain for the cooling zone, W

2.7 Cooling System Capacity

2.7.1 Nominal Cooling System Capacity:

The nominal cooling system capacity for the cooling zone shall be calculated as follows:

$CSC_{ncz} = LM_{cz} \times HG_{scz}$

Where

CSC_{ncz} = nominal cooling system capacity for the zone, W

LM_{cz} = latent load multiplier (1.3) for the cooling zone

HG_{scz} = total sensible heat gain determined according to clause 2.6., W

2.7.2. Minimum Cooling System Capacity:

The cooling system capacity for the cooling zone shall not be less than the nominal cooling system capacity (CSC_{ncz}) determined according to clause 2.7.1.

3 COMPLIANCE & VERIFICATION

3.1 The results of the calculations as well as key variables used as the basis for the calculation shall be described in a format substantially similar to the form set out in Appendix A.

APPENDICES

Appendix A: (normative); Cooling Zone Design Summary

Appendix B: (normative); List of Terms

Appendix C: (informative); Commentary

B.C. SINGLE ZONE COOLING CAPACITY

BCBC 9.33.3.1.; 9.33.5.1.

B.C. SZCG
Form Set Ver 1.0a

These documents issued for the use of _____

and may not be used by any other persons without authorization. Documents for permit and/or construction are signed in red. 1

PROJECT # 2

BUILDING LOCATION

Model: 3	Site: 6
Address: 4	Lot: 7
City & Province: 5	Postal Code: 8

COOLING ZONE COMPLIANCE

Designated Room(s): ar	Units: ☐ Imperial ☐ Metric b

Minimum Cooling Capacity: _____ btuh c

DESIGN CONDITIONS

Outdoor Temp: 28	Indoor Temp: 29	Adjacent Temp: 23	Cooilng Zone Area 21
Weather Location: 12	Ventilation Rate 22	HRV/ERV? Yes/No 23	ATRE %: 21

BUILDING COMPONENTS & ASSEMBLIES FACING OUTSIDE

Item A 31	Item B 34
Item C 32	Item D 35
Item E 32	Item F 35

BUILDING COMPONENTS & ASSEMBLIES FACING ADJACENT SPACES

Item A 31	Item B 34
Item C 32	Item D 35
Item E 32	Item F 35

ATTACHED DOCUMENTS & NOTES

Line 1: i
Line 2:
Line 3:
Line 4:
Line 5: j

CALCULATIONS PERFORMED BY

Name: 55	Designers Signature, Stamp Imprint or other certification mark 68	I, _____ have reviewed and take responsibility for the design work described in this document & I am qualified in the appropriate categories. 63
Company: 56		Accreditation Reference 1 64
Address: 57		Accreditation Reference 2 65
City & Prov 58		Issued for: (date) 66
Postal Cod 59		Issued for: (date) 67
Phone: 60		**Page: 1 of**
Fax: 61		
E-mail: 62		

Area for Software vendors information, logo, contact info, version number etc 69

HVAC DESIGNERS OF CANADA

teca thermal environmental comfort association

Province of BC:
Guideline on Overheating Protection in Dwelling Units

APPENDIX B (normative)

LIST OF TERMS

$CZODTD_C$ = Cooling Zone to outside design temperature difference, °C

T_{OC} = outdoor design temperature as specified in Clause 2.1.2. °C

CZT_{IC}= Cooling zone design temperature for cooling as specified in Clause 2.1.1. °C

$CZADTD_C$ = Cooling zone to adjacent space design temperature difference, °C

AT_{OC} = Adjacent unconditioned space design temperature as specified in Clause 2.1.3. °C

$CZADTD_C$ = Cooling Zone to Adjacent space design temperature difference, °C

HG_{CRR} = total conductive heat gain for the cooling zone, W

HG_{COP} = heat gain through opaque building assemblies between the cooling zone and the outsid W

HG_{COT} = heat gain through transparent or translucent building assemblies between the cooling zone room and the outside, W

HG_{COAP} = heat gain through opaque building assemblies between the cooling zone and adjacent unconditioned spaces, W

HG_{CAT} = heat gain through transparent or translucent building assemblies between the cooling zone and adjacent unconditioned spaces, W

HG_{CCZ} = total conductive heat gain for the cooling zone, W

HG_{SPRR} = sensible heat gain due to occupants, W.

HG_{LAECZ} = sensible heat gain due to lights, appliances and electric plug loads.

HG_{SALCZ} = sensible heat gain due to air leakage for the cooling zone, or HG_{SALB} = sensible heat gain due to air leakage for the building determined according to F280 12 clause 6.2.6., W

LR_{CCZ} = 0.3 Air Changes per Hour

VO_{cz} = volume of the cooling zone measured on the inside dimensions, m^3

HG_{svcz} = sensible heat gain due to ventilation for the cooling zone, W

ATRE = adjusted total recovery efficiency of the HRV/ERV, expressed as a fraction, or zero if there is no ATRE reported or if there is no heat recovery.

VC_{cz} = the ventilation airflow rate determined according to clause 2.3.2.

HG_{ccz} = Total Conductive Heat gain for the zone determined according to clause 2.5.5., W.

HG_{scz} = total sensible heat gain for the cooling zone, W

CSC_{ncz} = nominal cooling system capacity for the zone, W

LM_{cz} = latent load multiplier (1.3) for the cooling zone