Presented to:

Energy Save New West

Right-Sizing HVAC Equipment & CSA F280 for Part 9 Buildings

Presented by:

Todd Backus, P.Eng.

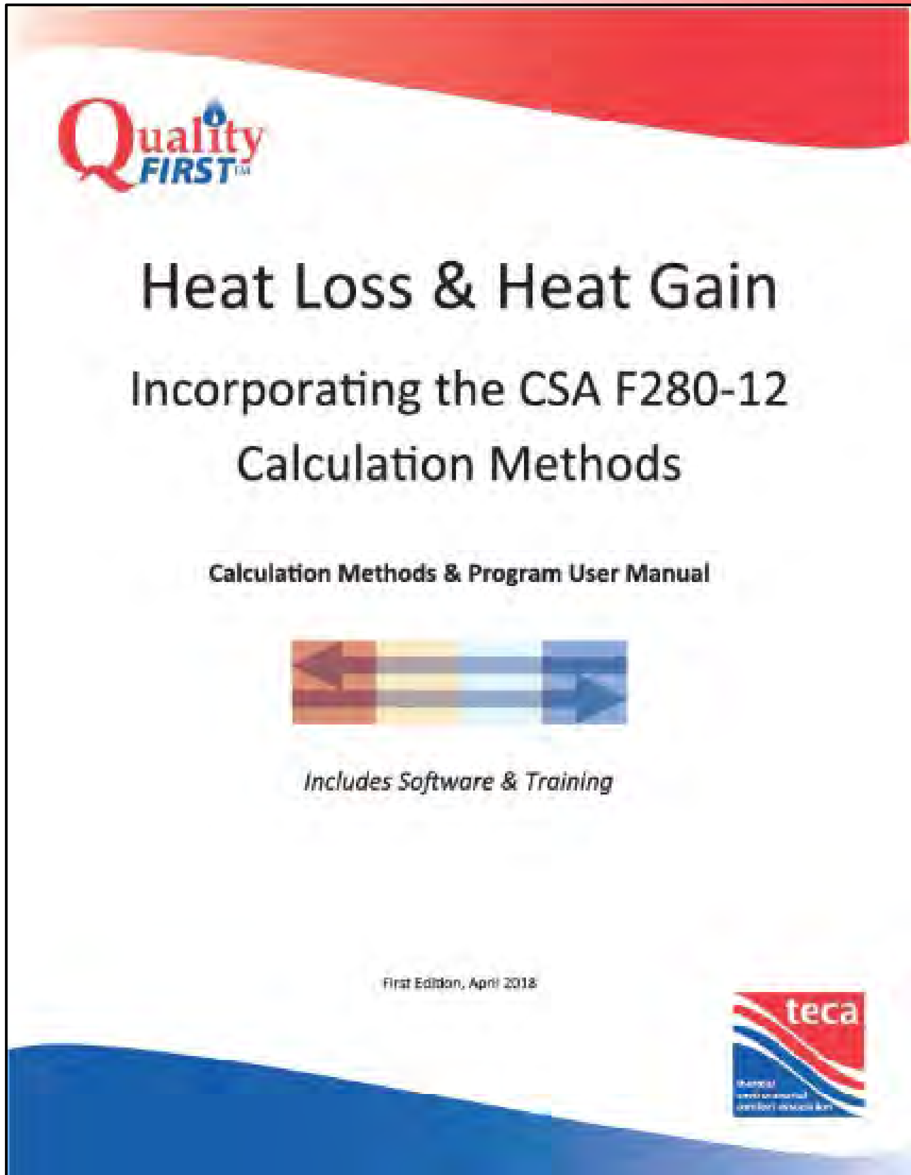
December 12th, 2024

AGENDA

1. Introduction
2. Code Requirements
3. CSA F280-12 Standard
4. HLHG Calculation Example
5. 26°C Refuge Room Example
    - When Cooling is Required
6. Right-Sizing HVAC Equipment
    - Ventilation
    - Heat Pumps
7. Q & A

ABOUT TECA

- Non-Profit Trade Association
- Our Mission:
  - Further Education in the HVAC Industry
  - Develop & Provide Training in the HVAC Industry
  - Practical Training for Trades People & Inspectors
  - Advocate for the HVAC Trades to Government
  - Advise Regulators & Building Officials on Best Practices


Quality FIRST™

Heat Loss & Heat Gain

Incorporating the CSA F280-12 Calculation Methods

Calculation Methods & Program User Manual

Includes Software & Training

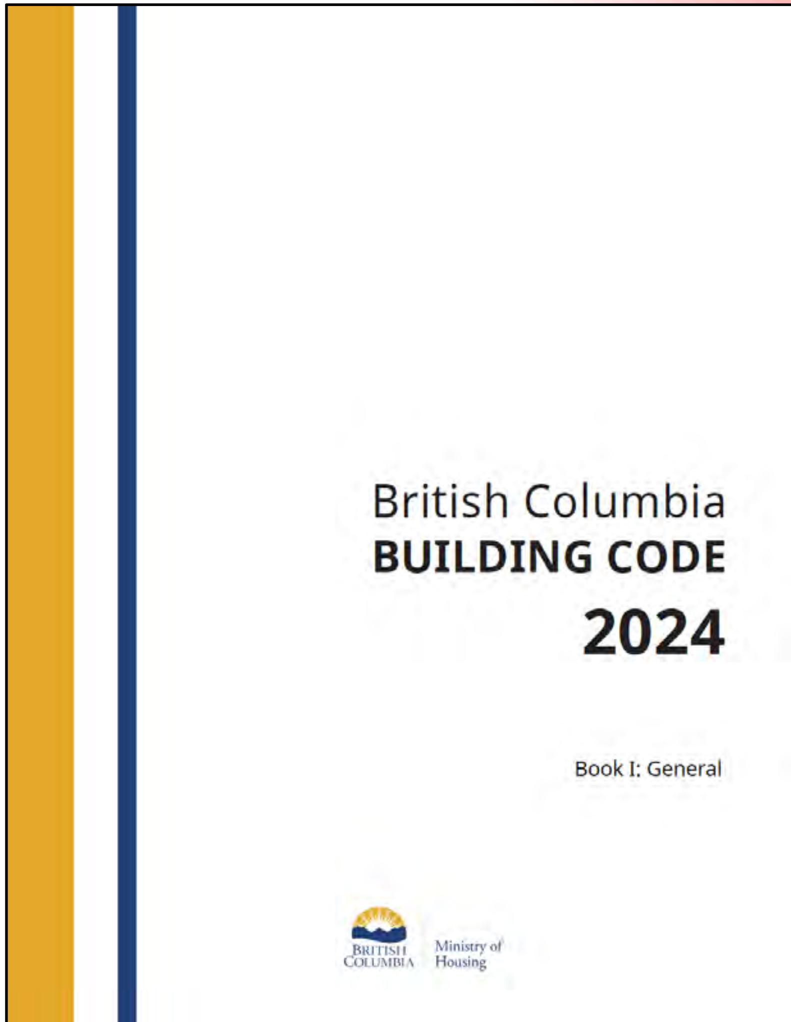
First Edition, April 2018

teca

teca
thermal environmental comfort association

CODE REQUIREMENTS

- Heating & Cooling Equipment to be sized using CSA F280-12 standard
- Design temperatures are prescriptive
  - Indoor Setpoint Temperatures
  - Outdoor Design Temperatures
- One room must be able to maintain 26°C
  - <u>*Applies to BCBC Only</u>



CODE REQUIREMENTS: CSA F280

9.33.5.1. Capacity of Heating and Cooling Appliances

1) The **required capacity of heating and cooling appliances** located in a dwelling unit and serving only that dwelling unit, shall be determined in accordance with **CSA F280**, "Determining the required capacity of residential space heating and cooling appliances" except that the design temperatures shall conform to Subsection 9.33.3.

CODE REQ: TEMPERATURES

9.33.3.1. Indoor Design Temperatures

1) At the outside winter design temperature, required heating facilities shall be capable of maintaining an indoor air temperature of not less than
   a) 22°C in all living spaces,
   b) 18°C in unfinished basements,
   c) 18°C in common service rooms, ancillary spaces and exits in houses with a secondary suite, &
   d) 15°C in heated crawl spaces.

CODE REQ: COOLING

9.33.3.1. Indoor Design Temperatures

2) At the outside summer design temperature, **required cooling** facilities shall be capable of maintaining an indoor air temperature of **not more than 26°C** in at least one living space in each dwelling unit.

*NOTE: Sentence **9.33.3.1. 2)** applies only to the BCBC.

CODE REQ: OUTDOOR TEMP.

9.33.3.2. Outdoor Design Temperatures

1) The outdoor conditions to be used in designing heating and air-conditioning systems shall be determined in conformance with Article 1.1.3.1.

1.1.3.1. Climatic and Seismic Values

3) The **<u>outside winter design temperatures</u>** determined from Appendix C shall be those listed for the **<u>January 2.5%</u>** values.

5) The **<u>outside summer design temperatures</u>** determined from Appendix C shall be those listed for the **<u>July 2.5% dry</u>** values.

Table C-2
Climatic Design Data for Selected Locations in British Columbia
Forming Part of Appendix C

Province and Location	Elev., m	Design Temperature January 2.5% °C	Design Temperature January 1% °C	Design Temperature July 2.5% Dry °C	Design Temperature July 2.5% Wet °C	Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, 1/50, mm	Ann. Rain, mm	Moist. Index	Ann. Tot. Ppn., mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50 S_s	Snow Load, kPa, 1/50 S_r	Hourly Wind Pressures, kPa 1/10	Hourly Wind Pressures, kPa 1/50
British Columbia																
100 Mile House	1040	-30	-32	29	17	5030	10	48	300	0.4	425	60	2.6	0.3	0.27	0.35
Abbotsford	70	-8	-10	29	20	2860	12	112	1525	1.6	1600	160	2.0	0.3	0.33	0.44
Agassiz	15	-9	-11	31	21	2750	8	128	1650	1.7	1700	160	2.4	0.7	0.35	0.47
Alberni	12	-5	-8	31	19	3100	10	144	1900	2.0	2000	220	2.6	0.4	0.24	0.32
Ashcroft	305	-24	-27	34	20	3700	10	37	250	0.3	300	80	1.7	0.1	0.29	0.38
Bamfield	20	-2	-4	23	17	3080	13	170	2870	3.0	2890	280	1.0	0.4	0.38	0.50
Beatton River	840	-37	-39	26	18	6300	15	64	330	0.5	450	80	3.3	0.1	0.23	0.30
Bella Bella	25	-5	-7	23	18	3180	13	145	2715	2.8	2800	350	2.6	0.8	0.40	0.50
Bella Coola	40	-14	-18	27	19	3560	10	140	1500	1.9	1700	350	4.5	0.8	0.29	0.39
Burns Lake	755	-31	-34	26	17	5450	12	54	300	0.6	450	100	3.4	0.2	0.29	0.39
Cache Creek	455	-24	-27	34	20	3700	10	37	250	0.3	300	80	1.7	0.2	0.29	0.39
Campbell River	20	-5	-7	26	18	3000	10	116	1500	1.6	1600	260	2.8	0.4	0.41	0.48
Carmi	845	-24	-26	31	19	4750	10	64	325	0.4	550	60	3.6	0.2	0.29	0.38
Castlegar	430	-18	-20	32	20	3580	10	54	560	0.6	700	60	4.2	0.1	0.26	0.34
Chetwynd	605	-35	-38	27	18	5500	15	70	400	0.6	625	60	2.4	0.2	0.30	0.40
Chilliwack	10	-9	-11	30	20	2780	8	139	1625	1.7	1700	160	2.2	0.3	0.35	0.47
Colwood Region Colwood (Colwood Corners)	64	-6	-8	26	18	2900	10	100	1000	1.13	1030	220	1.7	0.3	0.48	0.63
Colwood (Royal Bay Village)	20	-5	-7	24	17	2600	8	80	910	1.05	930	220	1.2	0.3	0.48	0.63
Colwood (Triangle Mountain)	220	-7	-9	25	17	3300	10	105	11885	1.29	1225	220	2.5	0.3	0.48	0.63
Comox	15	-7	-9	27	18	2930	10	106	1175	1.3	1200	260	2.4	0.4	0.41	0.48
Courtenay	10	-7	-9	28	18	2930	10	106	1400	1.5	1450	260	2.4	0.4	0.41	0.48
Cranbrook	910	-26	-28	32	18	4400	12	59	275	0.3	400	100	3.0	0.2	0.25	0.33
Crescent Valley	585	-18	-20	31	20	3650	10	54	675	0.8	850	80	4.2	0.1	0.25	0.33
Crofton	5	-4	-6	28	19	2880	8	86	925	1.1	950	160	1.8	0.2	0.32	0.40
Dawson Creek	665	-38	-40	27	18	5900	18	75	325	0.5	475	100	2.5	0.2	0.30	0.40
Dease Lake	800	-37	-40	24	15	6730	10	45	265	0.6	425	50	2.8	0.1	0.23	0.30
Dog Creek	450	-28	-30	29	17	4800	10	48	275	0.4	375	100	1.8	0.2	0.27	0.35
Duncan	10	-6	-8	28	19	2980	8	103	1000	1.1	1050	180	1.8	0.4	0.31	0.39
Elko	1065	-28	-31	30	19	4600	13	64	440	0.5	650	100	3.6	0.2	0.30	0.40
Fernie	1010	-27	-30	30	19	4750	13	118	860	0.9	1175	100	4.5	0.2	0.30	0.40
Fort Nelson	465	-39	-42	28	18	6710	15	70	325	0.6	450	80	2.4	0.1	0.23	0.30
Fort St. John	685	-35	-37	26	18	5750	15	72	320	0.5	475	100	2.8	0.1	0.29	0.39
Glacier	1145	-27	-30	27	17	5800	10	70	625	0.8	1500	80	9.4	0.2	0.24	0.32

CLIMATIC DATA

Appendix C Climatic and Seismic Information for Building Design in Canada

Table C-2
Climatic Design Data for Selected Locations in British Columbia
Forming Part of Appendix C

Province and Location	Elev., m	Design Temperature				Degree-Days Below 18°C	15 Min. Rain, mm	One Day Rain, 1/50, mm	Ann. Rain, mm	Moist. Index	Ann. Tot. Ppn., mm	Driving Rain Wind Pressures, Pa, 1/5	Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa	
		January		July 2.5%												
		2.5% °C	1% °C	Dry °C	Wet °C								S_s	S_r	1/10	1/50
British Columbia																
100 Mile House	1040	-30	-32	29	17	5030	10	48	300	0.4	425	60	2.6	0.3	0.27	0.35
Abbotsford	70	-8	-10	29	20	2860	12	112	1525	1.6	1600	160	2.0	0.3	0.33	0.44
Agassiz	15	-9	-11	31	21	2750	8	128	1650	1.7	1700	160	2.4	0.7	0.35	0.47
Alberni	12	-5	-8	31	19	3100	10	144	1900	2.0	2000	220	2.6	0.4	0.24	0.32
Ashcroft	305	-24	-27	34	20	3700	10	37	250	0.3	300	80	1.7	0.1	0.29	0.38
Bamfield	20	-2	-4	23	17	3080	13	170	2870	3.0	2890	280	1.0	0.4	0.38	0.50

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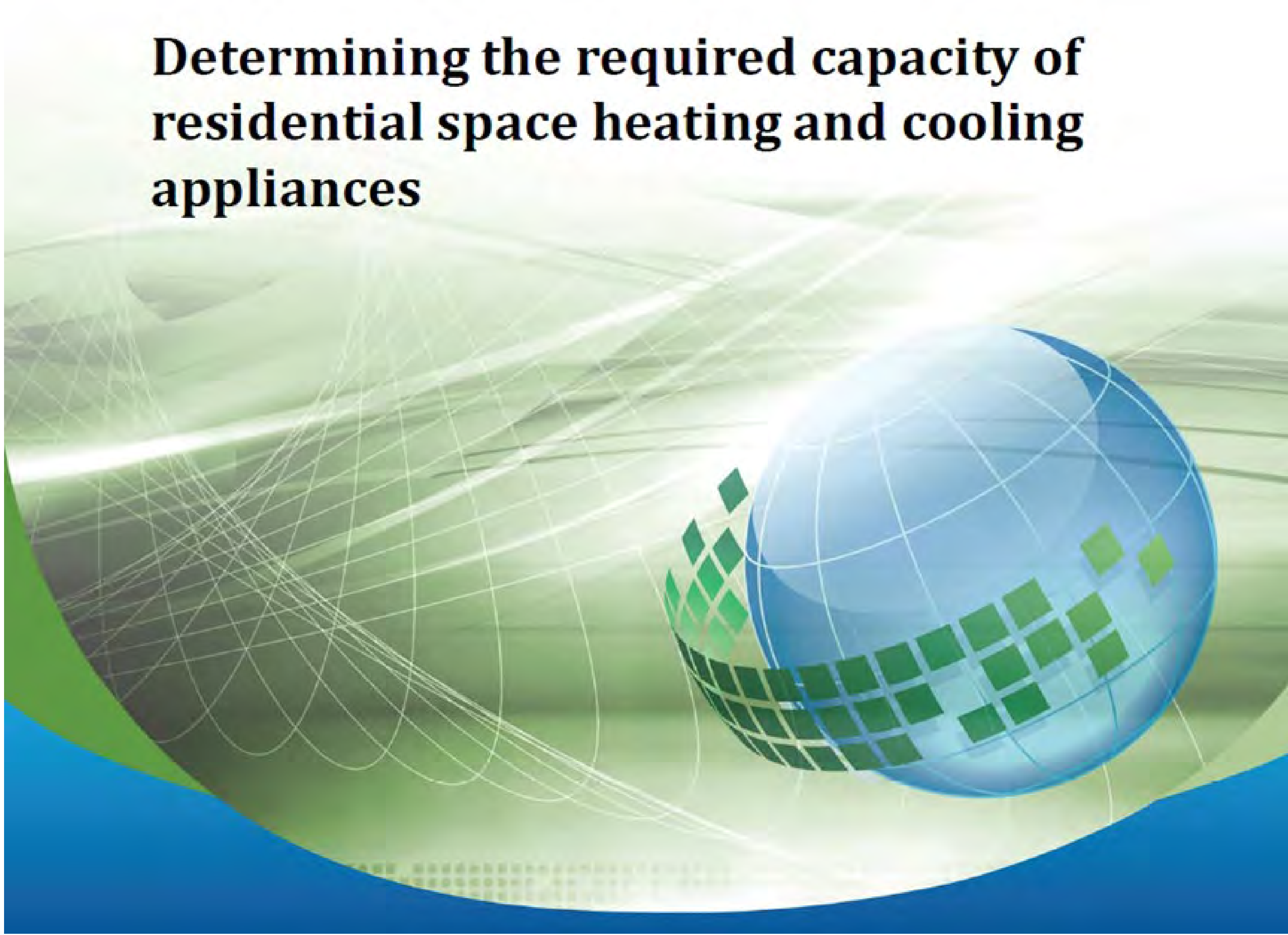
CSA F280-12 (R2021)

CSA Group



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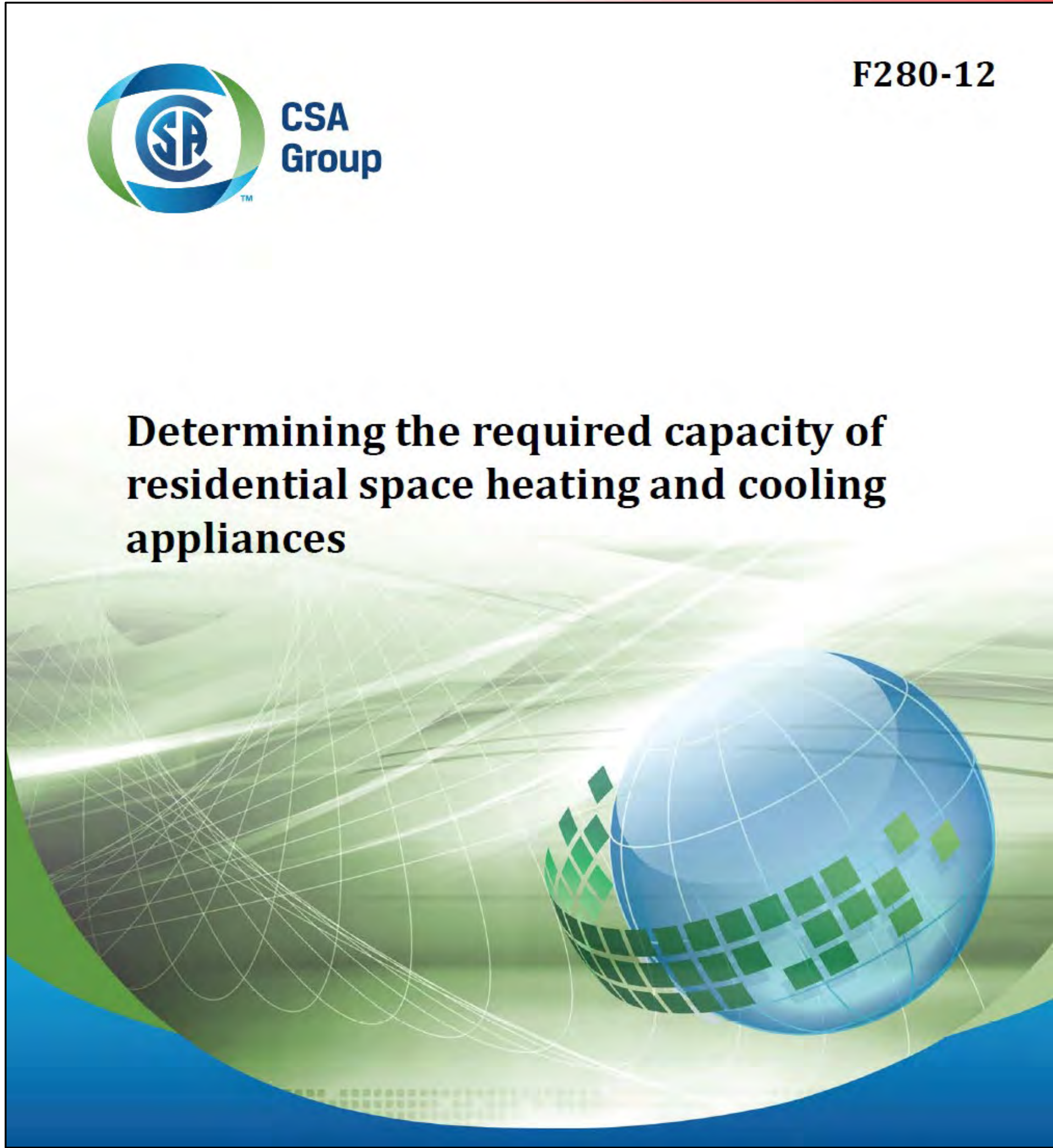
CSA F280 STANDARD

Scope of CSA F280-12 (R2021):

- Calculation method for heat loss & heat gain
- Used for selecting equipment
- Applies to Part 9 Buildings
- **<u>Does not</u>** comment on distribution systems or installation practices
- **<u>Only outputs peak loads!</u>**


F280-12

CSA Group

Determining the required capacity of residential space heating and cooling appliances

CSA F280 STANDARD

- Designed for **whole** dwelling heating & cooling
- **NOT** designed to model a single room
  - Assumptions must be made for an accurate model
  - No guidelines available for a refuge room modeling
  - **TECA & HVACDC: Writing refuge room modeling guidelines**

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CSA F280 CALCULATORS

F280-12 Software Verified according to the procedure set out in F280-12, Section 8.

COMPANY NAME	SOFTWARE NAME	ROOM BY ROOM	WHOLE HOUSE	CONDITIONS	WEBSITE
Building Technology Services	Building Tech F280	✓	✓	Click Here	BuildingTech
Avenir Software Inc	HeatCAD/LoopCAD	✓	✓	Click Here	HeatCAD LoopCAD
Thermal Environmental Comfort Association	Teca Heat Loss & Heat Gain Calculator	✓	✓	Click Here	teca
Volta Research Inc	Volta Snap		✓	Click Here	volta SNAP
MiTek Inc	Right-Suite Universal	✓	✓	Click Here	www.wrightsoft.com
Sustainable HVAC Design Inc	Sustainable HVAC F280	✓	✓	Click Here	
McCallum HVAC Design Inc	Mecha F280	✓	✓	Click Here	MCCALLUM HVAC DESIGN INC design excellence with on time delivery

Current List of Certified Calculators: https://hvacdc.ca/?page_id=406

HVAC DESIGNERS OF CANADA
VERIFIED F280 SOFTWARE

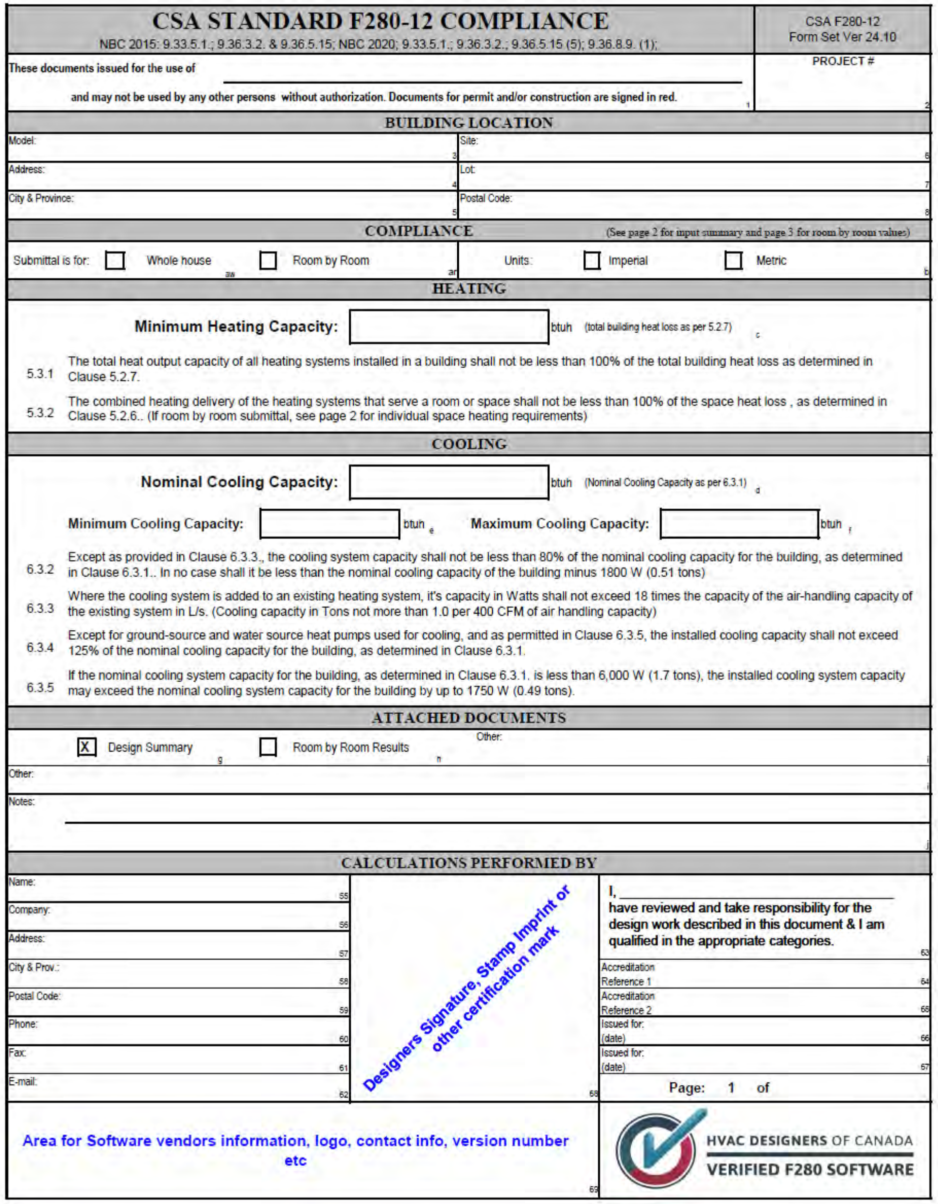
HVAC DESIGNERS OF CANADA – VERIFIED F280 SOFTWARE –

CSA F280 REPORTING

CSA Standard F280-12 Report:

- Currently, the results pages are not standardized between different calculators

- A standard report form will be required to simplify the review process



CSA STANDARD F280-12 COMPLIANCE

NBC 2015: 9.33.5.1.; 9.36.3.2. & 9.36.5.15; NBC 2020; 9.33.5.1.; 9.36.3.2.; 9.36.5.15 (5); 9.36.8.9. (1);

CSA F280-12
Form Set Ver 24.10

PROJECT #

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.

BUILDING LOCATION

Model:	Site:
Address:	Lot:
City & Province:	Postal Code:

COMPLIANCE (See page 2 for input summary and page 3 for room by room values)

Submittal is for: ☐ Whole house ☐ Room by Room — Units: ☐ Imperial ☐ Metric

HEATING

Minimum Heating Capacity: ______ btuh (total building heat loss as per 5.2.7)

5.3.1 The total heat output capacity of all heating systems installed in a building shall not be less than 100% of the total building heat loss as determined in Clause 5.2.7.

5.3.2 The combined heating delivery of the heating systems that serve a room or space shall not be less than 100% of the space heat loss , as determined in Clause 5.2.6.. (If room by room submittal, see page 2 for individual space heating requirements)

COOLING

Nominal Cooling Capacity: ______ btuh (Nominal Cooling Capacity as per 6.3.1)

Minimum Cooling Capacity: ______ btuh **Maximum Cooling Capacity:** ______ btuh

6.3.2 Except as provided in Clause 6.3.3., the cooling system capacity shall not be less than 80% of the nominal cooling capacity for the building, as determined in Clause 6.3.1.. In no case shall it be less than the nominal cooling capacity of the building minus 1800 W (0.51 tons)

6.3.3 Where the cooling system is added to an existing heating system, it's capacity in Watts shall not exceed 18 times the capacity of the air-handling capacity of the existing system in L/s. (Cooling capacity in Tons not more than 1.0 per 400 CFM of air handling capacity)

6.3.4 Except for ground-source and water source heat pumps used for cooling, and as permitted in Clause 6.3.5, the installed cooling capacity shall not exceed 125% of the nominal cooling capacity for the building, as determined in Clause 6.3.1.

6.3.5 If the nominal cooling system capacity for the building, as determined in Clause 6.3.1. is less than 6,000 W (1.7 tons), the installed cooling system capacity may exceed the nominal cooling system capacity for the building by up to 1750 W (0.49 tons).

ATTACHED DOCUMENTS

☒ Design Summary ☐ Room by Room Results Other:

Other:

Notes:

CALCULATIONS PERFORMED BY

Name:
Company:
Address:
City & Prov.:
Postal Code:
Phone:
Fax:
E-mail:

Designers Signature, Stamp Imprint or other certification mark

I, ______________________ have reviewed and take responsibility for the design work described in this document & I am qualified in the appropriate categories.

Accreditation Reference 1
Accreditation Reference 2
Issued for: (date)
Issued for: (date)

Page: 1 of

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

HVAC DESIGNERS OF CANADA
VERIFIED F280 SOFTWARE

CSA F280 REPORTING

Required Input Information:

- Client & Project Number
- Building Location
- Calculation Assumptions
- Design Temperatures
- Building Envelope Properties
- Contact Information of Designer

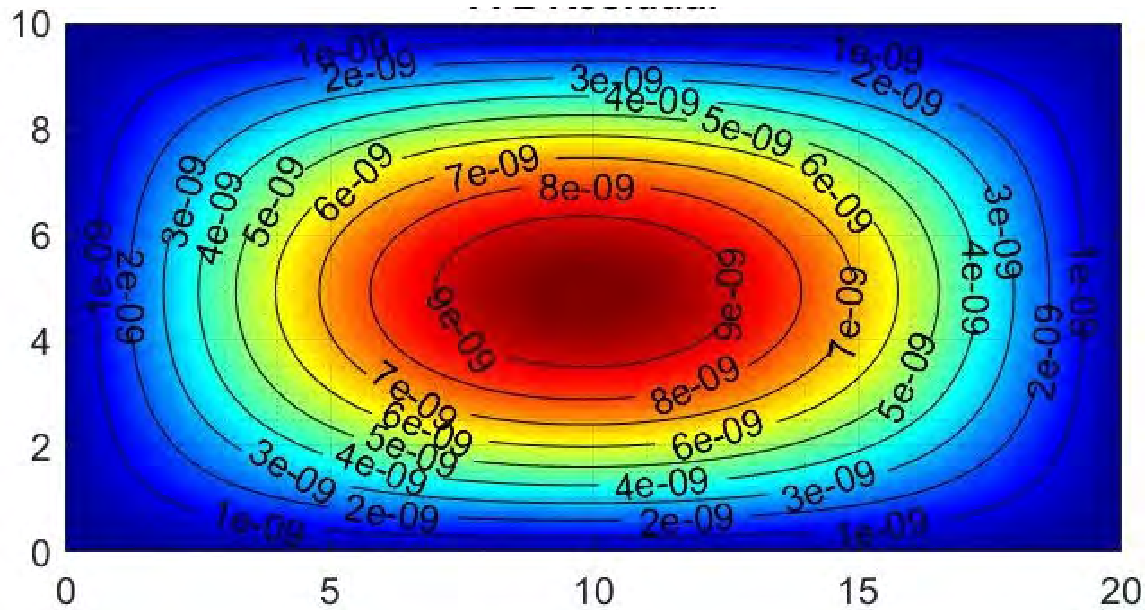
Table E.1
Inputs for preparing heat loss and gain calculation summary sheet
(See Clause 7.1 and Annex D.)

Field	Title	Description	Example
1	Drawings issued for	Client/company the heat loss gain calculations were performed for	John Doe Construction
2	Project number	Client/job code for the use of the issuer of the Heat Loss Gain Calculations	0402-96
BUILDING LOCATION		**Where the project is located**	
3	Model	Code or name designated to a plan set	Craftsman- Walkout-Option 2
4	Address	Municipal designated location of the project	496 Fake Street
5	City & Province	City (county, township, etc.) and province the project is located in	Toronto, Ontario
6	Site	Name of the development area the project is located in	Fakewood Heights
7	Lot	Numbered land parcel within the site	Lot 16, Phase II
8	Postal Code	Canada Post assigned postal code for the address	M6J 2P9
CALCULATIONS BASED ON		**The assumptions and data the heat loss gain calculation is based on**	
9	Dimensional information based on	Source of the component sizing data for the heat loss gain calculation	Anybody Design. Dwgs Dated 7/Oct/2010
10	Attachment	Building connection to another building's conditioned space	Detached, left/right/mid, top/bottom/mid
11	Number of stories	Floor levels in the building – Indicate if basement is included	2 + basement
12	Weather location	Weather data location selected in the heat loss gain calculations	Toronto
13	Ventilated?	Was the building's ventilation included in the heat loss gain calculation	Included
14	HRV?	Is an HRV used for the ventilation of the building?	Yes–Blowhard Cyclone 2WA

CSA F280 LIMITATIONS

Calculates Peak Loads:

- Outputs either BTU/hour (or Watts)
  - Energy over **Time**
  - Cannot simulate the build-up of heating over time
  - If the peak load can be satisfied, partial loads will also be satisfied



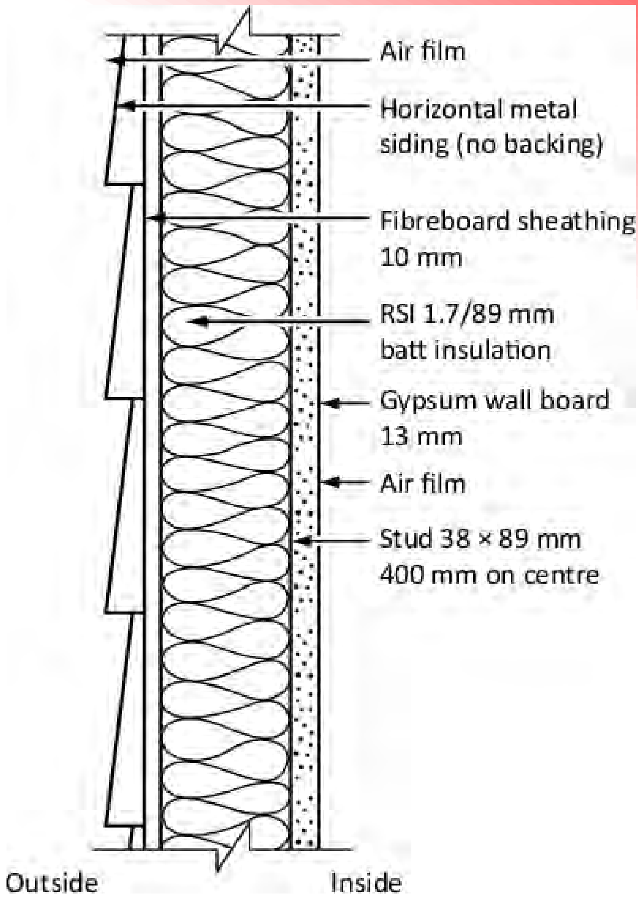
ABOVE GRADE WALL CALCULATIONS

Components of the Above Grade Wall Calculation:

$$\text{Heat Loss}_{AGW} = \frac{\text{Area}}{\text{R}} * \Delta\text{T}$$

Where:

- Heat Loss [W or BTUH] = Heat loss requirement at peak load
- Area [m^2 or ft^2] = The area of the wall (adjusted for stud spacing)
- R $\left[\frac{m^2 * °C}{W} \; or \; \frac{ft^2 * °F}{BTUH}\right]$ = Thermal resistance of wall assembly
- ΔT [°C or °F] = Indoor setpoint temperature - Outdoor design temperature



FENESTRATION CALCULATIONS

CSA: 6.2.2. Heat gain through transparent & translucent building assemblies

- Solar Heat Gain Coefficient (SHGC)
- Solar Radiation Incident on the Window (based on orientation & latitude)

$$\text{Heat Gain}_{CT} = \text{Area} * \left\{\frac{\Delta T}{R} + \text{SHGC} * \text{Solar}_o * \text{Latitude}_{Factor}\right\}$$

Estimated solar radiation (W/m²)

	North	South	East/West	Northeast/ Northwest	Southeast/ Southwest	Horizontal
Solar_o	93	160	285	194	252	534

$$\text{Latitude}_{Factor} = 1 + \{\text{Latitude} - 40\} * 0.0375$$

INTERNAL LOADS: CSA F280

External Loads:

- Conductive heat transfer, solar radiation, ventilation & leakage

Internal Loads for Heat Gain:

- Occupants: 70 W (240 BTUH) per person
- Electrical:
  - Min. 800 W (2,730 BTUH),
  - 4 W/m^2 (1.27 $BTUH/ft^2$) if > $200m^2$ (2,150 ft^2)

HLHG REPORT: BUILDING INFO

RESULTS *PROJECT #: Example. 453 West 12th Ave. || CSA F280*

These results have been generated by The TECA Heat Loss & Heat Gain Calculator (V5.04), which is Verified F280 Software

The heating and cooling loads calculated with this calculator tool are the sole responsibility of the user. This tool is to aid the user in applying to the CSA F280-12 calculation methods. The Thermal Environmental Comfort Association of BC accepts no responsibility for damages whatsoever, and offers no guarantee of equipment sizing or configuration.

BUILDING INFORMATION

CALCULATIONS PERFORMED FOR: James Bond

CALCULATIONS PERFORMED BY

NAME	Todd Backus
COMPANY	TECA
ADDRESS	123 Fake Street
CITY	Nanaimo
PROVINCE	BC
POSTAL CODE	V9R 1P3
PHONE	555-555-5555
FAX	-
EMAIL	tbackus@teca.ca

SOFTWARE LICENSING

COMPANY	TECA
NAME	Todd Backus
REG. #:	33816800

optional - operator logo, qualification/certification stamp, signature, BCIN qualification attestation, etc.

optional - include photo of house / building drawings here

PROJECT #:	Example
ADDRESS:	453 West 12th Ave.
CITY:	Vancouver
PROVINCE:	BC
POSTAL CODE:	V5Y 1V4
BUILDING MODEL:	
SITE:	
LOT:	
DESIGNER OF BUILDING DRAWINGS:	JM
DATE OF DRAWINGS:	March 21, 2024
BUILDING ATTACHMENT:	Detached
NUMBER OF FLOOR LEVELS:	3

NUMBER OF STOREYS: 2 *above grade floor levels*

PROJECT #: Example. 453 West 12th Ave.

WEATHER DATA	Vancouver (city hall)		
LATITUDE:	49.25	**LONGITUDE:**	-123.12
Summer Mean Daily Temperature Range	7 °C	**WINDOW SHADING:**	NO
VENTILATION SYSTEM	Dedicated HRV, 60CFM, ASE0.64, ATRE:0		
HEATING SYSTEM	radiant heating (in-floor or baseboards)		

FRONT OF HOUSE FACING DIRECTION: SW

is this value assumed? no

AIR TIGHTNESS / INFILTRATION	ACH50: 1, ELA: 96.5 cm², ELA @10Pa
is the air tightness value assumed?	yes
BUILDING SITE SHIELDING:	Suburban, forest
LOCAL WALL SHIELDING:	Open flat terrain, grass
LOCAL FLUE SHIELDING:	Open flat terrain, grass

INDOOR DESIGN TEMPERATURES: **# OF BEDROOMS:** 2

HEATING: 22°C, 71.6°F **# OF PEOPLE:** 3

COOLING: 24°C, 75.2°F

OUTDOOR DESIGN TEMPERATURES:

HEATING: -7°C, 19.4°F

COOLING: 28°C, 82.4°F

SOIL TEMPERATURE: 11 °C

Attached documents:

Assumptions noted (in addition to listed assumptions on page 1):

Notes from the calculator operator:

HLHG REPORT: BUILDING ASSEMBLY

PROJECT #: Example. 453 West 12th Ave.

BUILDING ENVELOPE ELEMENTS

WALLS

1/ (Wood Wall), Air Film - inside walls, // 1/2" Drywall, // 2*6, 16" OC w/ R6 Insulation, // 2" type 2 bread board as continuous insulation on exterior, // 1/2" Sheeting, // Wall Material - Softwood, air film - outside air; 29.91R-VALUE

CEILINGS

1/ (Ceiling), Air Film - inside ceiling, // 5/8 Drywall, // Ceiling Insulation, // 1/2" Sheathing, // 2" of type 2 insulation, air film - outside air; 57.84R-VALUE

INTERIOR FOUNDATION WALL

EXPOSED FLOOR

1/ (Floor - Exposed), Air Film - inside floors, // Hardwood, // Floor Insulation, // Aluminum Board, air film - outside air; 50.84R-VALUE

EXPOSED HEADER

1/ (Floor Header w/ Wood Walls); 32.3R-VALUE

2/ (Floor Header w/ Leger Boad); 35.37R-VALUE

WINDOWS

1/ (Door Window) double glazed, Fixed — Wood/Vinyl, insulating, clear, 6mm Air, USI: 3.13, SHGC: 0.59

2/ (Window - Typ) double glazed, Operable — Wood/Vinyl, insulating, clear, 6mm Air, USI: 2.44, SHGC: 0.49

SKYLIGHTS

DOORS

1/ (Door) Insulated metal — Polyurethane core, without storm door, USI: 0.91

SHADINGS

FOUNDATIONS

1/ [Basement / Lowest Floor] Concrete Slab & Walls, insulation: interior wall = 2.72RSI, exterior wall = 2.64RSI (configuration #69) // any first storey construction type, interior surface of wall insulated over full-height, exterior surface of wall insulated over full-height, sub-surface of floor slab fully insulated but no insulation under footings, thermal-break between walls and floor slab // AREA: 320ft², FULL PERIMETER: 72ft, EXPOSED PERIMETER: 72ft

WALLS

- 1/ (Wood Wall),
- Air Film - Inside Walls,
- 1/2" Drywall,
- 2*6, 16" OC w/ R6 Insulation,
- 2" Type 2 Bread Board as Continuous Insulation on Exterior,
- 1/2" Sheeting,
- Wall Material - Softwood,
- Air Film - Outside Air;

29.91 R-VALUE

HLHG REPORT: SUMMARY

HEAT LOSS & HEAT GAIN SUMMARY, (BTUH)

imperial

ROOM NAME	FLOOR LEVEL	FL AREA (ft^2)	HEAT LOSS TOTAL	HEAT GAIN SENS.	HEAT GAIN **TOTAL (sensible + latent)**
(#1)Bath #1	1	84	363	4	5
(#2)Bed #1	1	180	1935	2346	3050
(#3)Entrance - Basement	1	80	873	420	546
(#4)Kitchen & Living	2	344	3655	7178	9332
(#5)Bath #2	3	40	258	53	69
(#6)Hall & Laundry	3	89	684	495	644
(#7)Bed #2	3	215	2596	3592	4669

	AREA	HEAT LOSS	GAIN (sens.)	GAIN (total)
OVERALL BUILDING	1032	10365	14087	**18314**

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HLHG RESULTS REPORT

Results Output Page:

- Automatically creates a report
- Contains critical design information (per CSA Standard)
- Standardized results page submitted to Building Official (in progress)

CSA STANDARD F280-12 COMPLIANCE
NBC 2015: 9.33.5.1.; 9.36.3.2. & 9.36.5.15; NBC 2020; 9.33.5.1.; 9.36.3.2.; 9.36.5.15 (5); 9.36.8.9. (1);

CSA F280-12
Form Set Ver 24.10

These documents issued for the use of Teca
and may not be used by any other persons without authorization. Documents for permit and/or construction are signed in red.

PROJECT # 1

BUILDING LOCATION

Model:		Site:	
Address:	152 Nicola St W	Lot:	
City & Province:	Kamloops, BC	Postal Code:	

COMPLIANCE (See page 2 for input summary and page 3 for room by room values)

Submittal is for: ☐ Whole house ☑ Room by Room — Units: ☑ Imperial ☐ Metric

HEATING

Minimum Heating Capacity: 10,168 BTUH (total building heat loss as per 5.2.7)

5.3.1	The total heat output capacity of all heating systems installed in a building shall not be less than 100% of the total building heat loss as determined in Clause 5.2.7.
5.3.2	The combined heating delivery of the heating systems that serve a room or space shall not be less than 100% of the space heat loss , as determined in Clause 5.2.6.. (If room by room submittal, see page 2 for individual space heating requirements)

COOLING

Nominal Cooling Capacity: 30,577 BTUH (Nominal Cooling Capacity as per 6.3.1)

Minimum Cooling Capacity: 24,462 BTUH — **Maximum Cooling Capacity:** 38,221 BTUH

6.3.2	Except as provided in Clause 6.3.3., the cooling system capacity shall not be less than 80% of the nominal cooling capacity for the building, as determined in Clause 6.3.1.. In no case shall it be less than the nominal cooling capacity of the building minus 1800 W (0.51 tons)
6.3.3	Where the cooling system is added to an existing heating system, it's capacity in Watts shall not exceed 18 times the capacity of the air-handling capacity of the existing system in L/s. (Cooling capacity in Tons not more than 1.0 per 400 CFM of air handling capacity)
6.3.4	Except for ground-source and water source heat pumps used for cooling, and as permitted in Clause 6.3.5, the installed cooling capacity shall not exceed 125% of the nominal cooling capacity for the building, as determined in Clause 6.3.1.
6.3.5	If the nominal cooling system capacity for the building, as determined in Clause 6.3.1. is less than 6,000 W (1.7 tons), the installed cooling system capacity may exceed the nominal cooling system capacity for the building by up to 1750 W (0.49 tons).

ATTACHED DOCUMENTS

☐ Design Summary ☑ Room by Room Results Other:

Other:

Notes:

Assumptions:

CALCULATIONS PERFORMED BY

Name:	Andrew Byker
Company:	
Address:	7565 Ruby Place
City & Prov.:	Chilliwack, BC
Postal Code:	V2R 3B1
Phone:	604 991 7878
Fax:	
E-mail:	abyker@teca.ca

Designers Signature, Stamp Imprint or other certification mark

I, Andrew Byker have reviewed and take responsibility for the design work described in this document & I am qualified in the appropriate categories.

Accreditation Reference 1	
Accreditation Reference 2	
Issued for: (date)	
Issued for: (date)	
Page:	1 of 4

TECA HEAT LOSS & HEAT GAIN CALCULATOR V5.08
This calculator is CSA F280 verified

HVAC DESIGNERS OF CANADA
VERIFIED F280 SOFTWARE

CSA F280 HLHG EXAMPLE

<u>Site Information:</u>

- **Vancouver, BC**
  - **-7°C Winter Design Temperature**
  - **28°C Summer Design Temperature**
- 3 Story, 3,067 ft^2 detached home
- Indoor setpoint temperature modeled at **<u>26°C for cooling</u>**
  - **<u>CSA F280 specifies indoor setpoint of 24°C for cooling</u>**
- Net Zero building assemblies
- 5 Occupants
- HRV: 110 CFM with 82% ASE
- No window shades included

BASEMENT PLAN

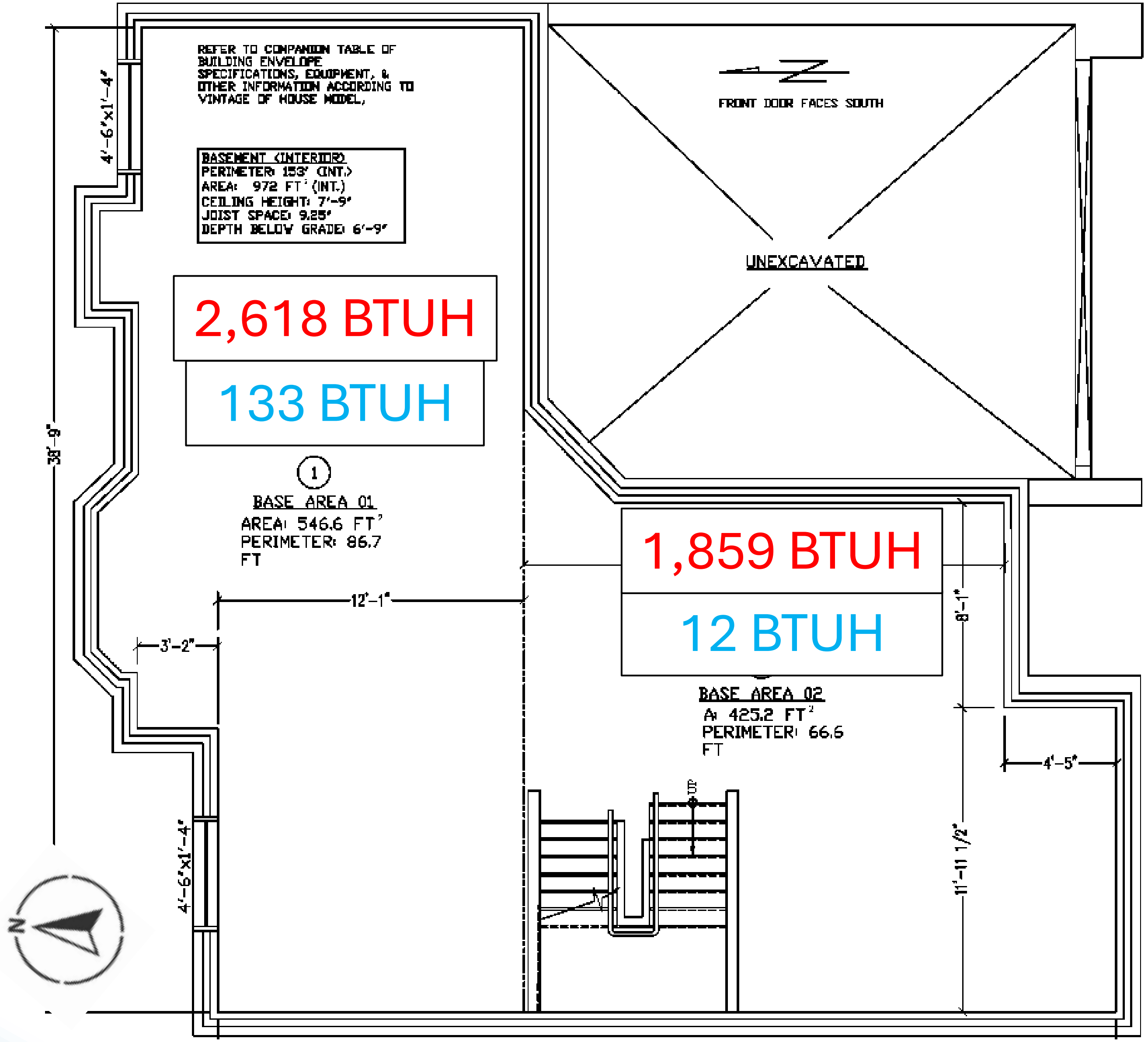
Heat Loss (Heating):

4,477 BTUH

Heat Gain (Cooling):

145 BTUH

*Mostly below grade



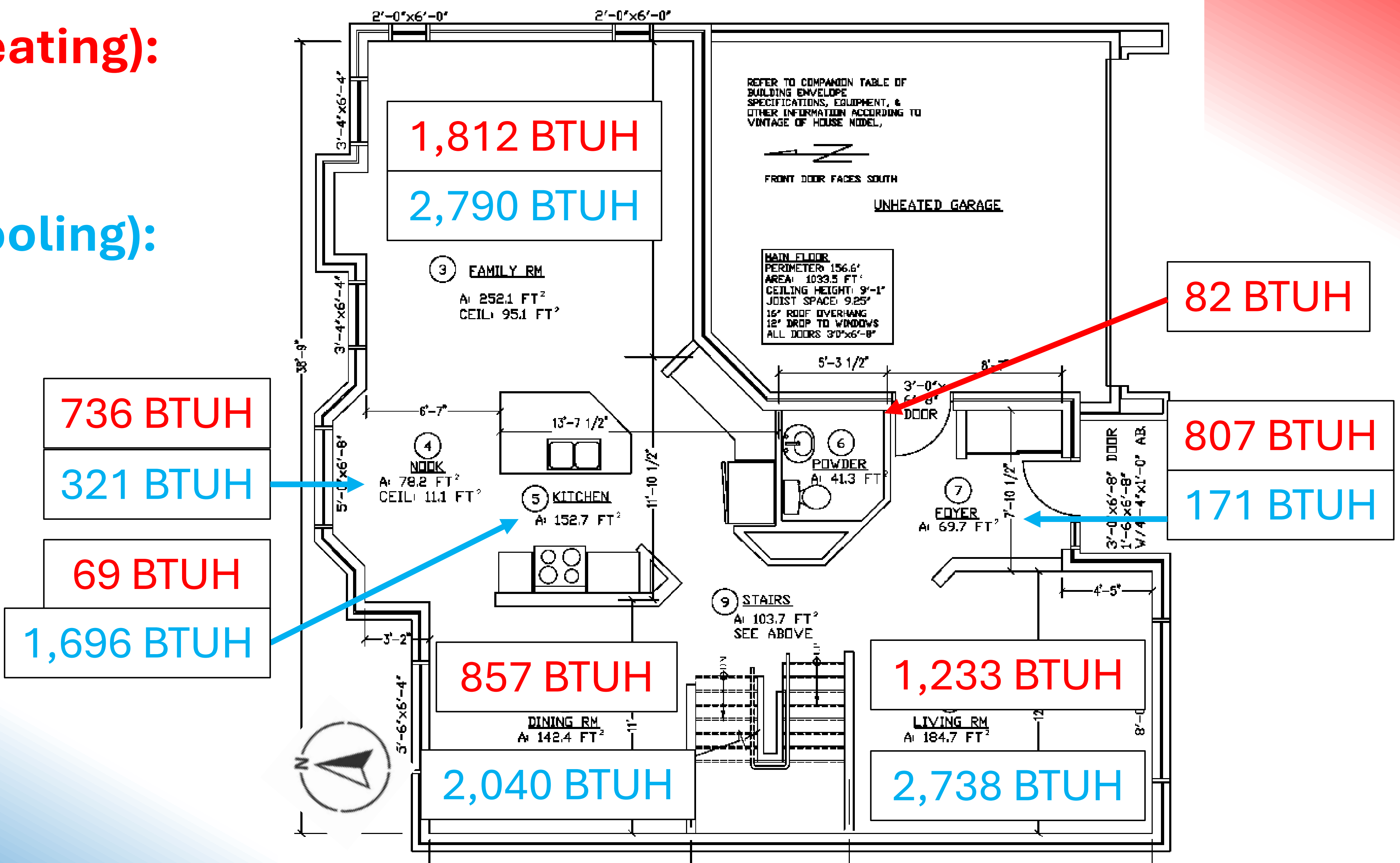
MAIN FLOOR PLAN

Heat Loss (Heating):

5,596 BTUH

Heat Gain (Cooling):

9,759 BTUH



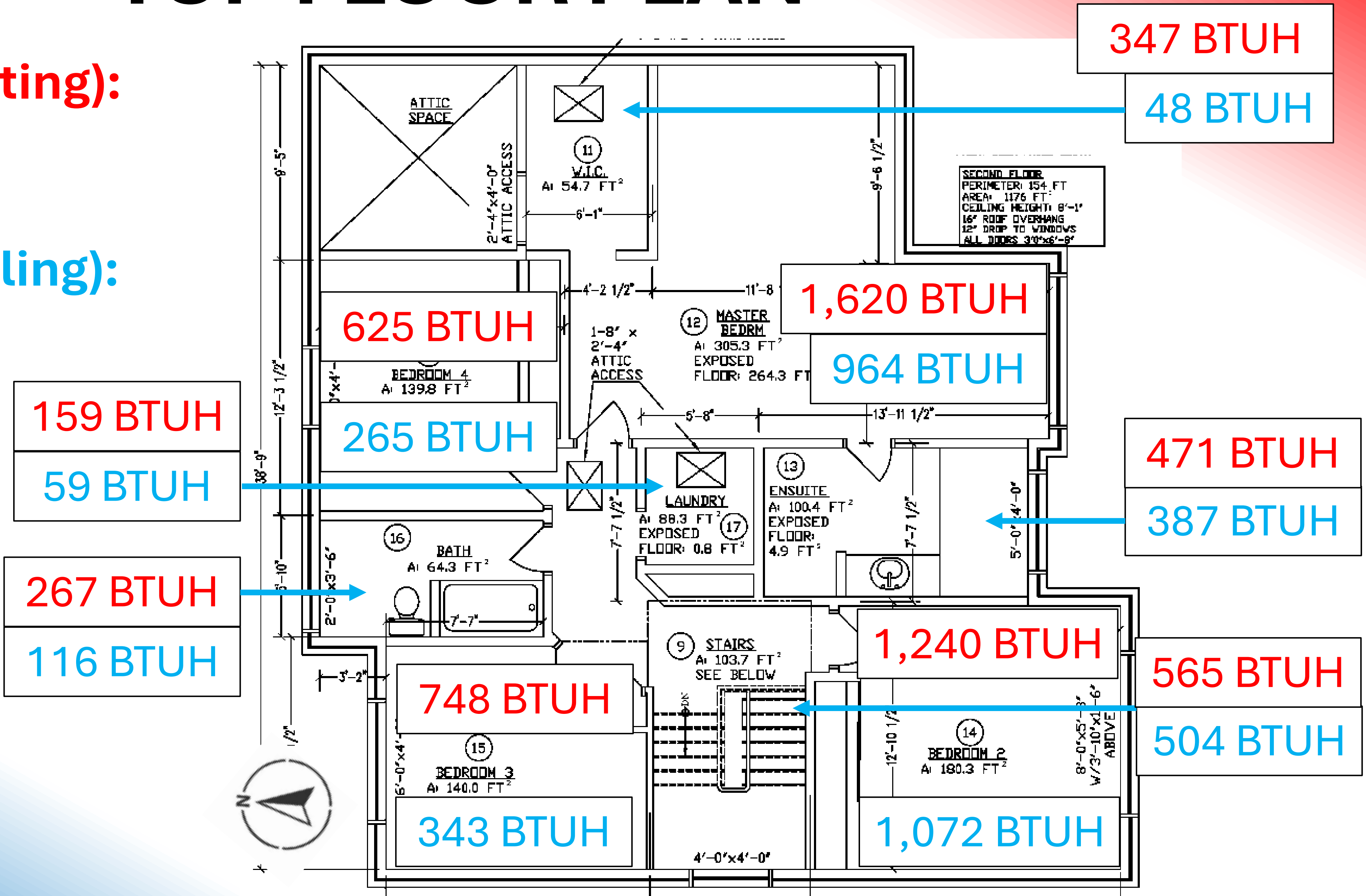
TOP FLOOR PLAN

Heat Loss (Heating):

6,042 BTUH

Heat Gain (Cooling):

3,758 BTUH



HEAT LOSS SUMMARY

Vancouver:

Temp. @ -7°C

Heat Loss:

16,115 BTUH

ROOM NAME	WAL.	CEI.	FLR.	WIN.	DR.	FND.	LEAK.	VENT.	DIST.	ADD.	TOTAL
(#18)BASE AREA 1	76			153		1262	803	324			**2618**
(#18)BASE AREA 2	58					1001	570	230			**1859**
(#18)FAMILY	542	85		845			242	98			**1812**
(#18)NOOK	162	10		426			98	40			**736**
(#18)KITCHEN	56						9	4			**69**
(#18)POWDER	67						11	4			**82**
(#18)ENTRY	138			183	334		108	44			**807**
(#18)LIVING	320			681			165	67			**1233**
(#18)STAIRS	163	92		204			76	31			**565**
(#18)DINING	252			445			115	46			**857**
(#18)W.I.C.	143	45			110		35	14			**347**
(#18)MASTER BEDROOM	335	272	269	516			162	66			**1620**
(#18)ENSUITE	55	89	5	255			47	19			**471**
(#18)BEDROOM2	252	160		653			124	50			**1240**
(#18)BEDROOM3	212	125		306			75	30			**748**
(#18)BATH	84	56		89			27	11			**267**
(#18)LAUNDRY		72	1		64		16	6			**159**
(#18)BEDROOM4	207	124		204			63	25			**623**
	WAL.	CEI.	FLR.	WIN.	DR.	FND.	LEAK.	VENT.	DIST.	ADD.	TOTAL
TOTAL BUILDING	**3121**	**1130**	**275**	**4960**	**509**	**2262**	**2747**	**1110**			**16115**

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HEAT GAIN SUMMARY

Vancouver:

Temp. @ 28°C

Heat Gain:

13,659 BTUH

***Indoor temp @ 26°C**

ROOM NAME	WAL.	CEI.	FLR.	WIN.	DR.	LEAK.	VENT.	DIST.	INT.	SENS.	TOTAL
(#18)BASE AREA 1	7			88		2	6			103	**133**
(#18)BASE AREA 2	9					0	1			10	**12**
(#18)FAMILY	27	50		706		14	45		1305	2146	**2790**
(#18)NOOK	8	6		216		4	13			247	**321**
(#18)KITCHEN									1305	1305	**1696**
(#18)POWDER											
(#18)ENTRY				122		2	7			132	**171**
(#18)LIVING	29			715		13	43		1305	2106	**2738**
(#18)STAIRS	21	54		286		6	21			388	**504**
(#18)DINING	20			226		4	14		1305	1569	**2040**
(#18)W.I.C.	8	26				1	2			37	**48**
(#18)MASTER BEDROOM	26	159		504		12	40			741	**964**
(#18)ENSUITE		52		225		5	16			298	**387**
(#18)BEDROOM2	24	94		648		14	44			824	**1072**
(#18)BEDROOM3	17	73		156		4	14			264	**343**
(#18)BATH	4	33		45		1	5			89	**116**
(#18)LAUNDRY		42				1	2			45	**59**
(#18)BEDROOM4	13	73		104		3	11			204	**265**
	WAL.	CEI.	FLR.	WIN.	DR.	LEAK.	VENT.	DIST.	INT.	SENS.	TOTAL
TOTAL BUILDING	**212**	**663**		**4041**		**88**	**285**		**5218**	**10507**	**13659**

REFUGE ROOM CALCULATIONS

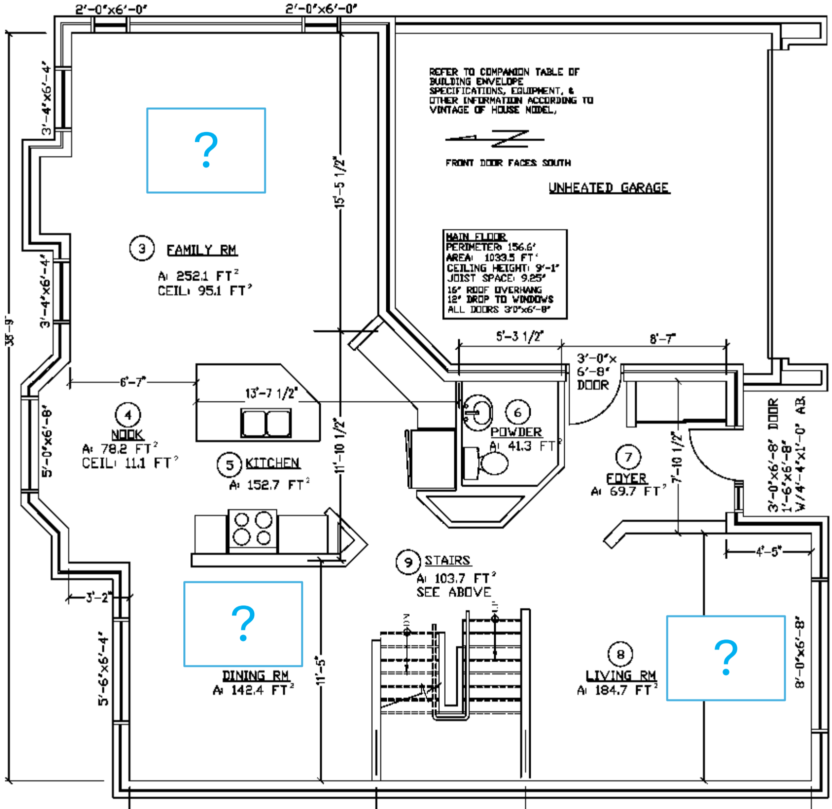
9.33.3.1. Indoor Design Temperatures

2) At the outside summer design temperature, **required cooling** facilities shall be capable of maintaining an indoor air temperature of **not more than 26°C** in at least one living space in each dwelling unit.

MODELING A REFUGE ROOM

How to Model (IN MY OPINION):

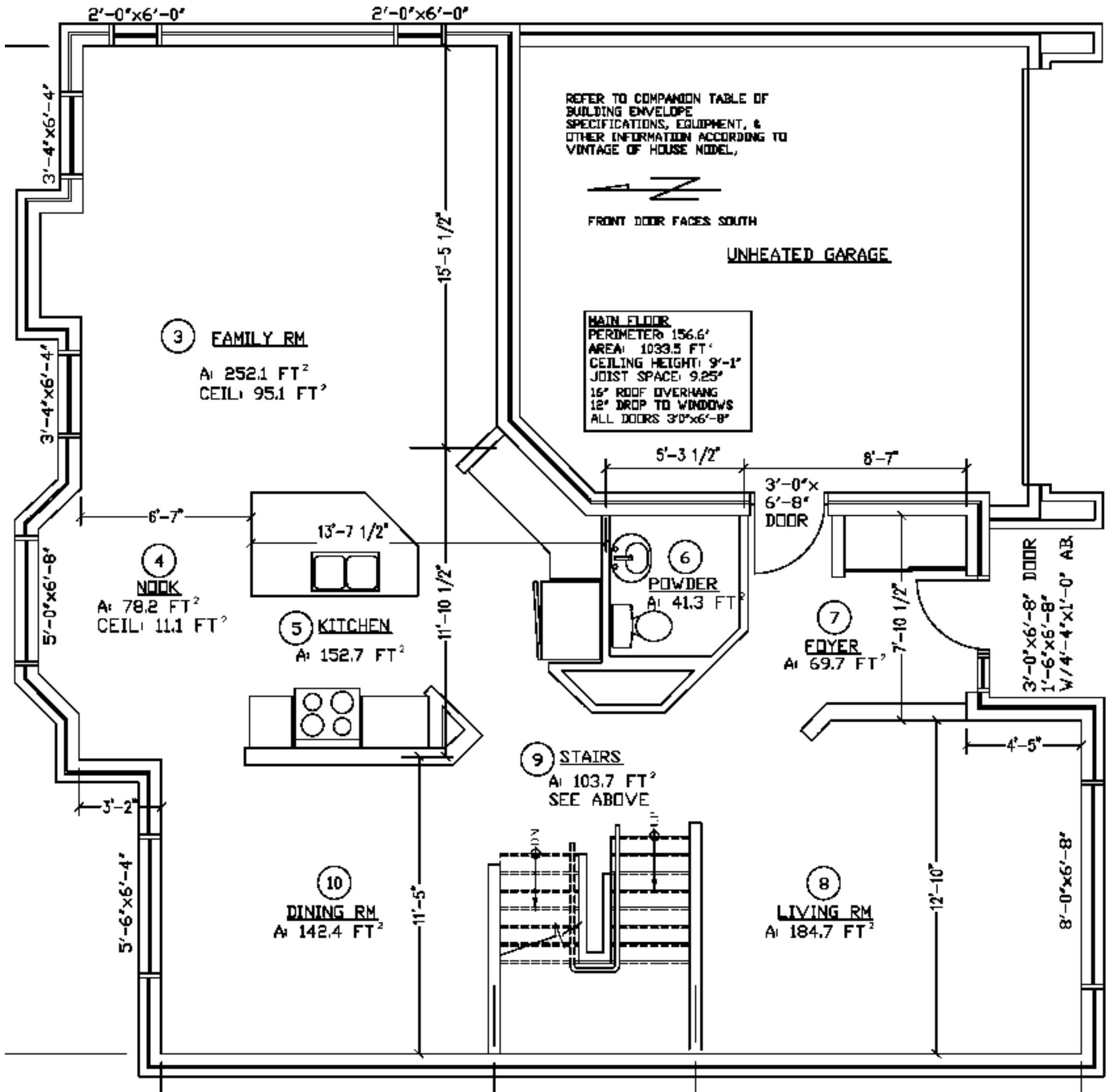
- Calculate heat gain on the single room (or open area)
- Interior surfaces assumed to be at outdoor design conditions
- Include all dwelling occupants in the refuge room
- Assume a min. electrical load of 800 Watts (2,730 BTUH)
- Indoor setpoint temperature of 26°C
    - CSA F280 Recommends 24°C



SELECTING A REFUGE ROOM

- Must be a finished room
- Consider passive cooling strategies
  - Can some rooms be isolated?
  - Are window shades available?
- Consider occupant comfort
- Review decision after calculation

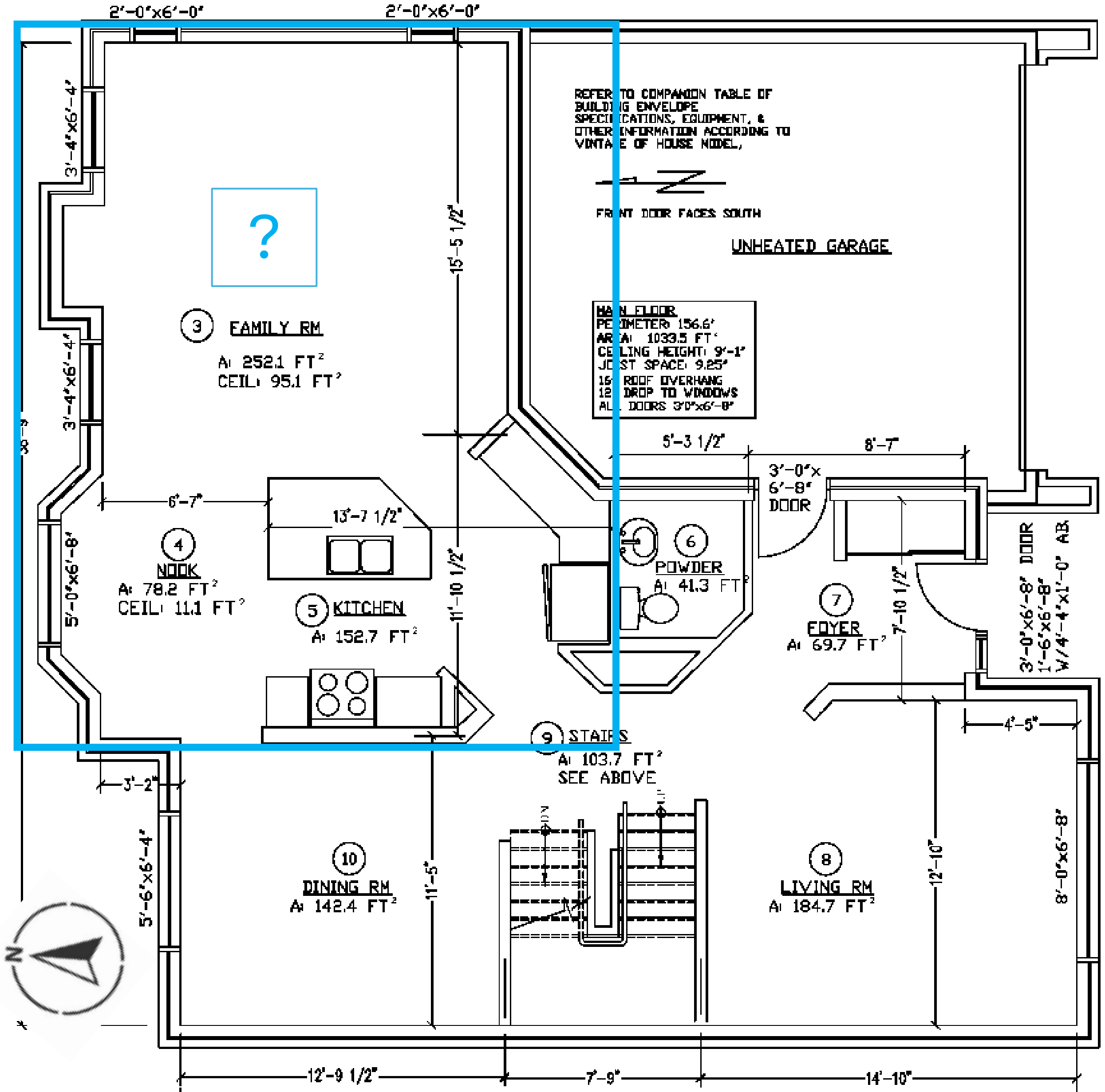
Is this the best room?



REFUGE ROOM: FAMILY ROOM

Family, Kitchen & Nook as a Refuge Room:

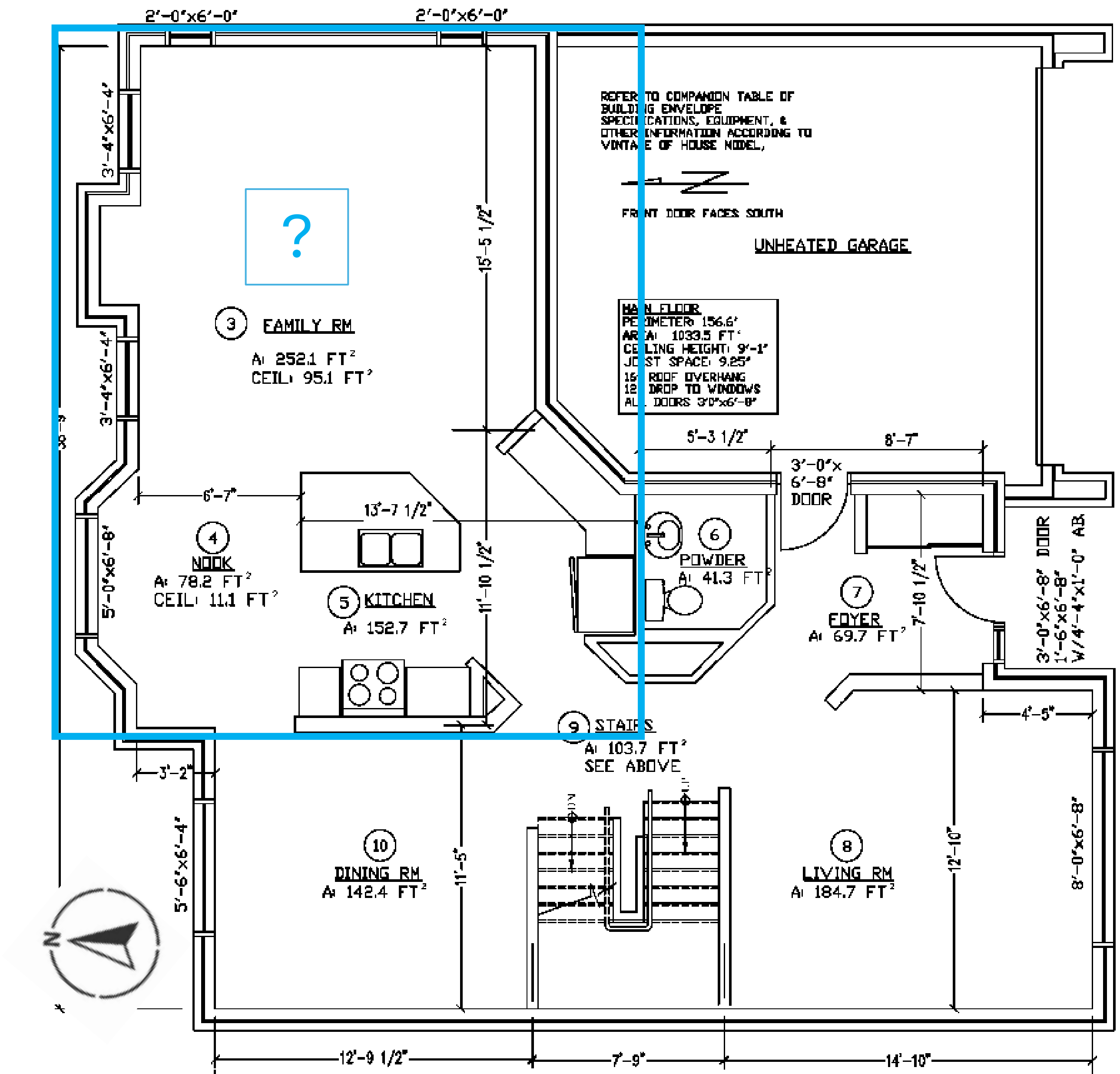
- High occupant comfort level
- Cools a large area
- Excellent selection



REFUGE ROOM: LIVING ROOM

Converting to a Refuge Room:

- Add South & West walls
- Add ceiling
- Add exposed floor
- Add entire ventilation load
- Include all occupants
- Include electrical load



REFUGE ROOM: LIVING ROOM

ROOM NAME	WAL.	CEI.	FLR.	WIN.	DR.	LEAK.	VENT.	DIST.	INT.	SENS.	TOTAL
(#18)BASE AREA 1	7			88		2	6			103	**133**
(#18)BASE AREA 2	9					0	1			10	**12**
(#18)FAMILY	27	50		706		14	45		1305	2146	**2790**
(#18)NOOK	8	6		216		4	13			247	**321**
(#18)KITCHEN									1305	1305	**1696**
(#18)POWDER											
(#18)ENTRY				122		2	7			132	**171**
(#18)LIVING	29			715		13	43		1305	2106	**2738**
(#18)STAIRS	21	54		286		6	21			388	**504**
(#18)DINING	20			226		4	14		1305	1569	**2040**
(#18)W.I.C.	8	26				1	2			37	**48**
(#18)MASTER BEDROOM	26	159		504		12	40			741	**964**
(#18)ENSUITE		52		225		5	16			298	**387**
(#18)BEDROOM2	24	94		648		14	44			824	**1072**
(#18)BEDROOM3	17	73		156		4	14			264	**343**
(#18)BATH	4	33		45		1	5			89	**116**
(#18)LAUNDRY		42				1	2			45	**59**
(#18)BEDROOM4	13	73		104		3	11			204	**265**
	WAL.	**CEI.**	**FLR.**	**WIN.**	**DR.**	**LEAK.**	**VENT.**	**DIST.**	**INT.**	**SENS.**	**TOTAL**
TOTAL BUILDING	**212**	**663**		**4041**		**88**	**285**		**5218**	**10507**	**13659**

Family & Kitchen Heat Gain:

4,807 BTUH

Family & Kit. as Refuge Room:

7,305 BTUH

CSA F280-12

Allows for 80% of total heat gain for min. sizing.

Indoor temperature is 26°C rather than 24°C

	WAL.	CEI.	FLR.	WIN.	DR.	LEAK.	VENT.	DIST.	INT.	SENS.	TOTAL
Family, Nook & Kitchen	61	252		923		35	425		3924	5619	7305

REVIEWING A REFUGE ROOM

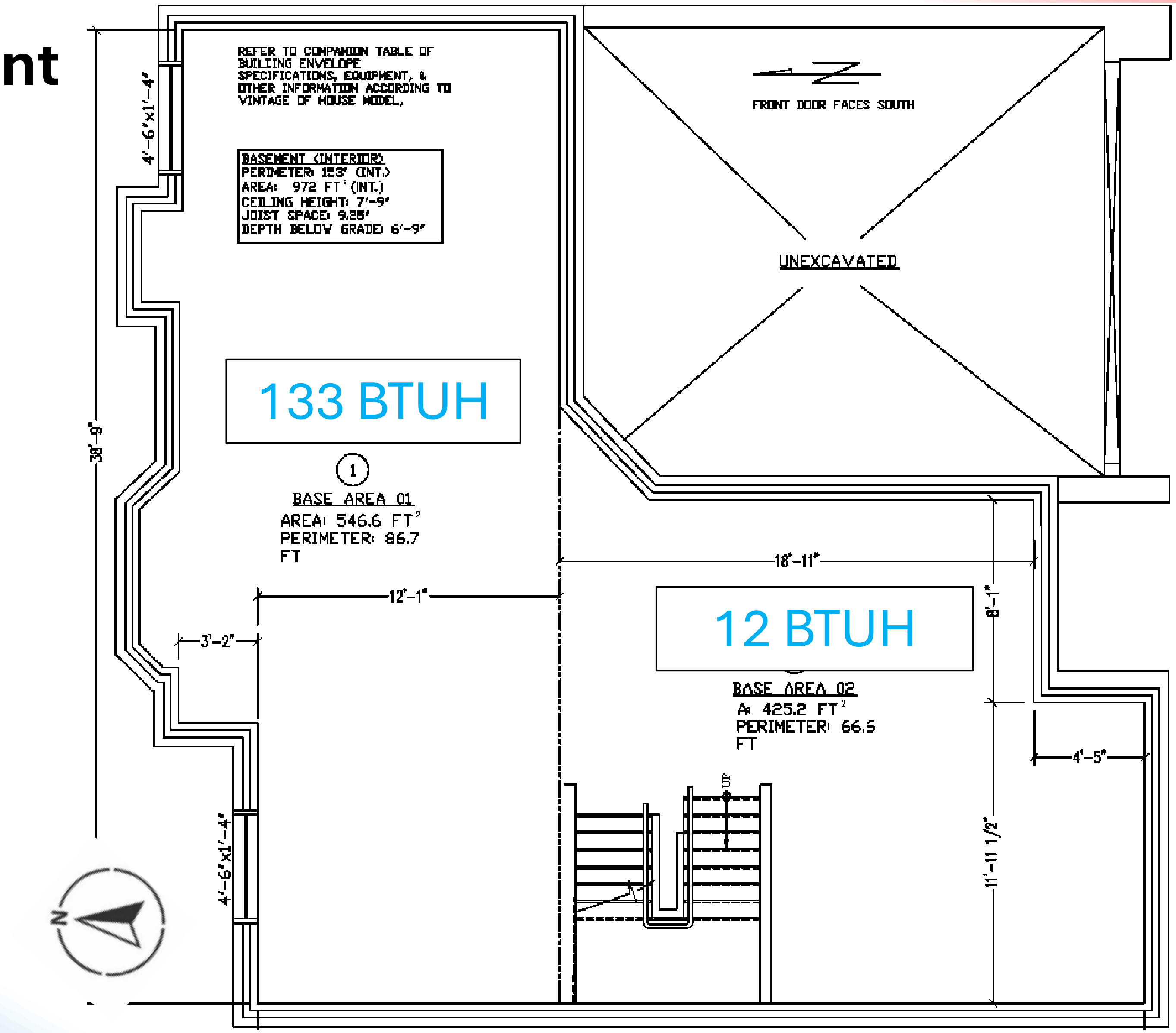
Modeling Considerations:

- Is the heat gain calculation performed on the **entire dwelling**, not just the living room?
  - Interior walls and floors will be assumed to have **no heat transfer** because they are modeled as conditioned spaces
- Have the **occupants** been included in the calculation?
- Have the **internal loads** been distributed to multiple rooms?

BASEMENT PLAN

Why not use the basement as a refuge room?

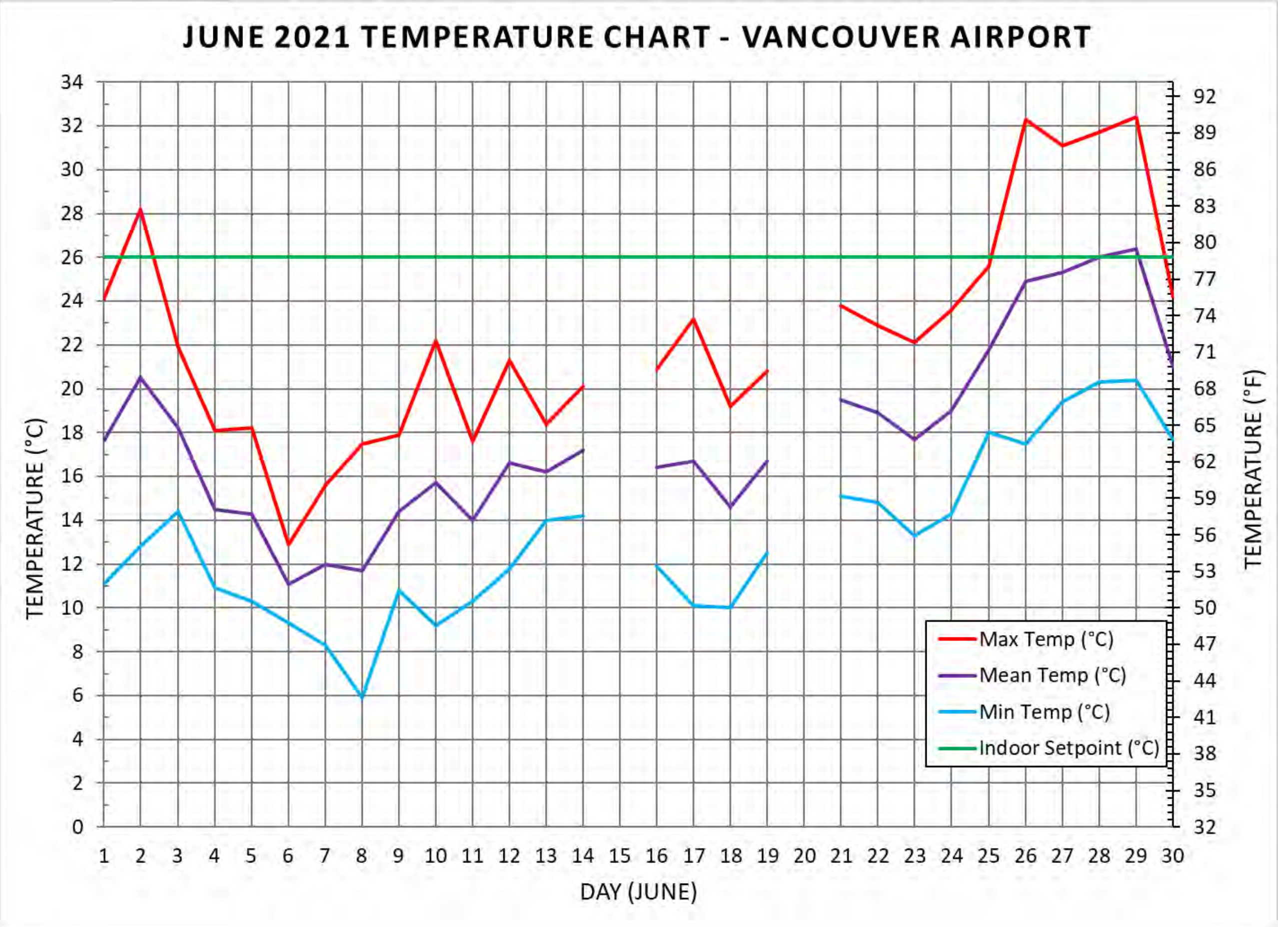
- Internal loads
  - Add 3,924 BTUH
- Occupant comfort
  - Very poor!
- Does this area even require cooling?



COOLING REQUIREMENTS

How do you prove cooling is not required?

- Simulation data must be provided
  - Weather data
  - Building thermal mass
  - Propagation of heat transfer
- Complex analysis!
- Engineer required?



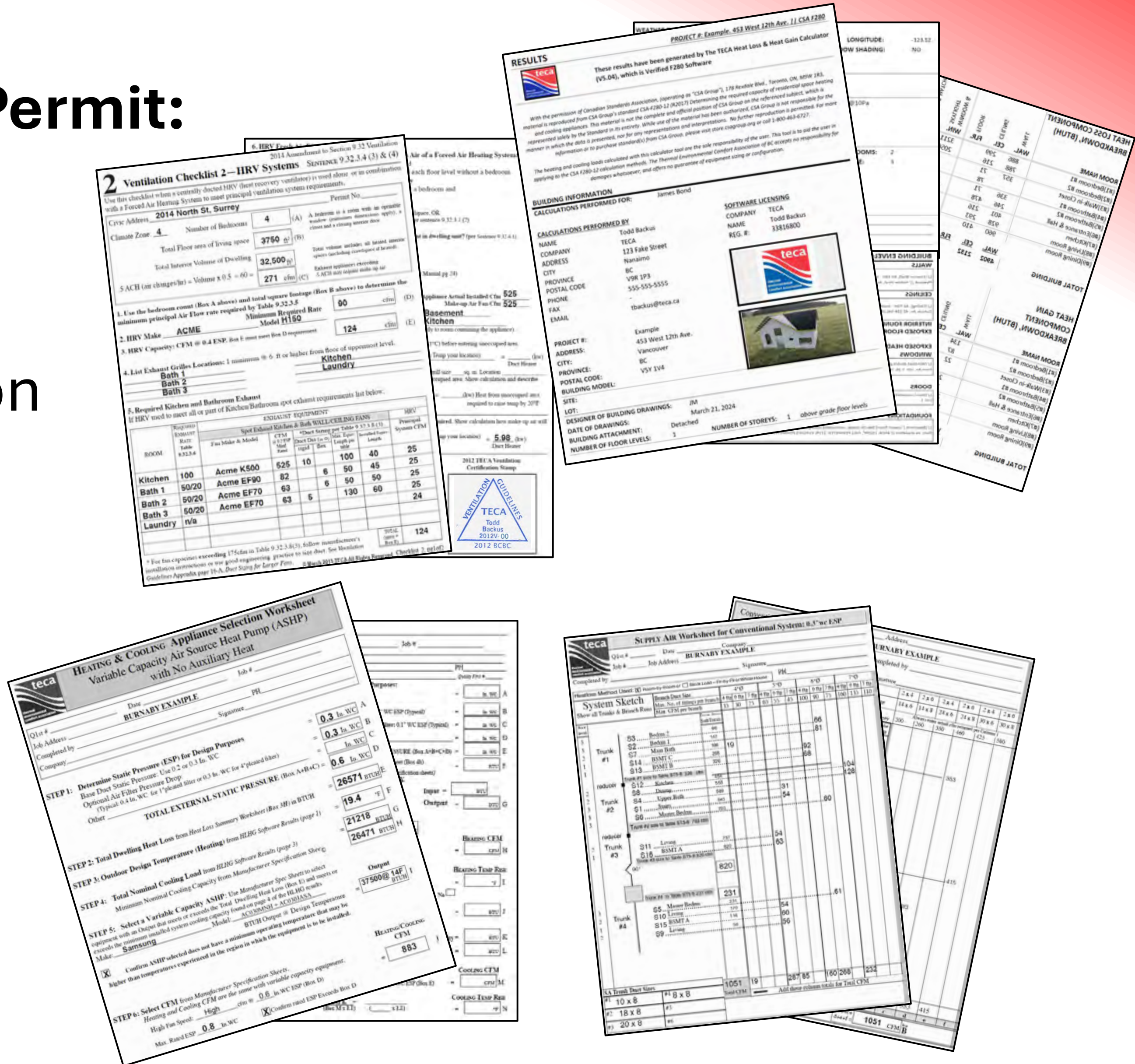
RIGHT SIZING HVAC EQUIPMENT

- Code compliance
- Equipment selection
  - Proper calculations & documentation
- Distribution system sizing
  - Ductwork
  - Radiant
- Verification

DESIGN & PLAN CHECKING

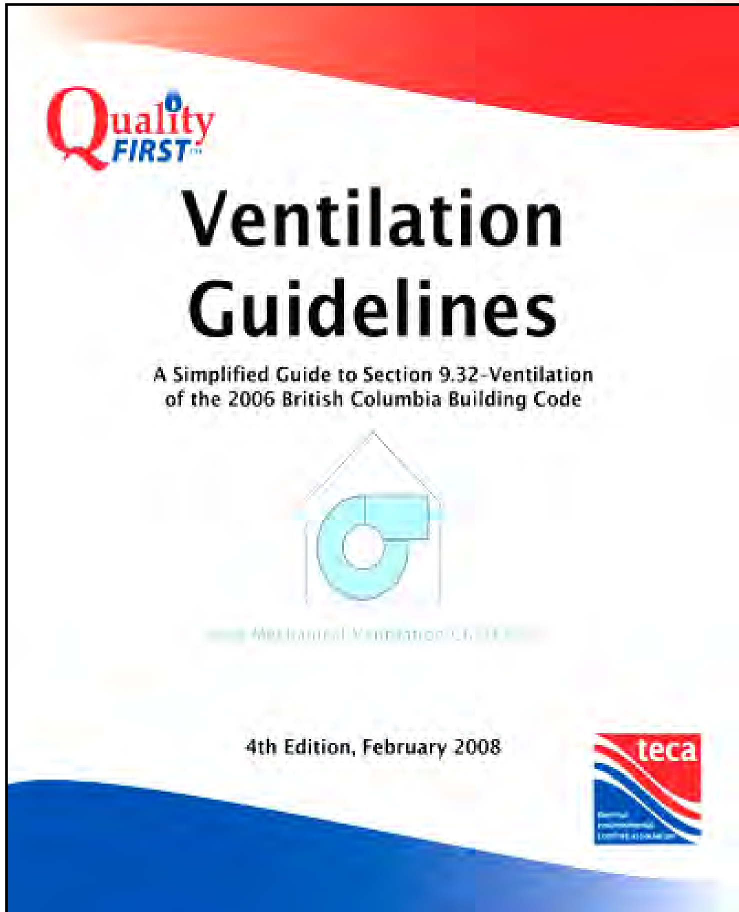
Documents to Submit for Builder Permit:

- Ventilation Checklist
- Heat Loss & Heat Gain Calculation
- Equipment Selection Worksheet
- Design Summary
- System Drawings & Schematics
- Required Permits



9.32 VENTILATION

- Every dwelling requires its own ventilation system
- Ventilation requires exhaust air & outside air
- Minimum airflow rates are prescribed
- Kitchens & bathrooms must have min. ventilation
- Pipe diameters are sized based on airflow & equivalent lengths
- Protection against depressurization (NAFFVA)



VENTILATION REQUIREMENTS

9.32.3.4. Ventilation Systems Supply Air

Outdoor air must be provided to:

i. **each bedroom**

ii. **each floor level without a bedroom,** and

iii. ancillary spaces that contain an exhaust device, where the space is not within a dwelling unit in a house with a secondary suite and where the house with a secondary suite contains a fuel-fired space-heating appliance or fuel-fired water-heating appliance of other than direct-vented or mechanically vented types,

A-9.32.3.4. Principle Ventilation System Supply Air.

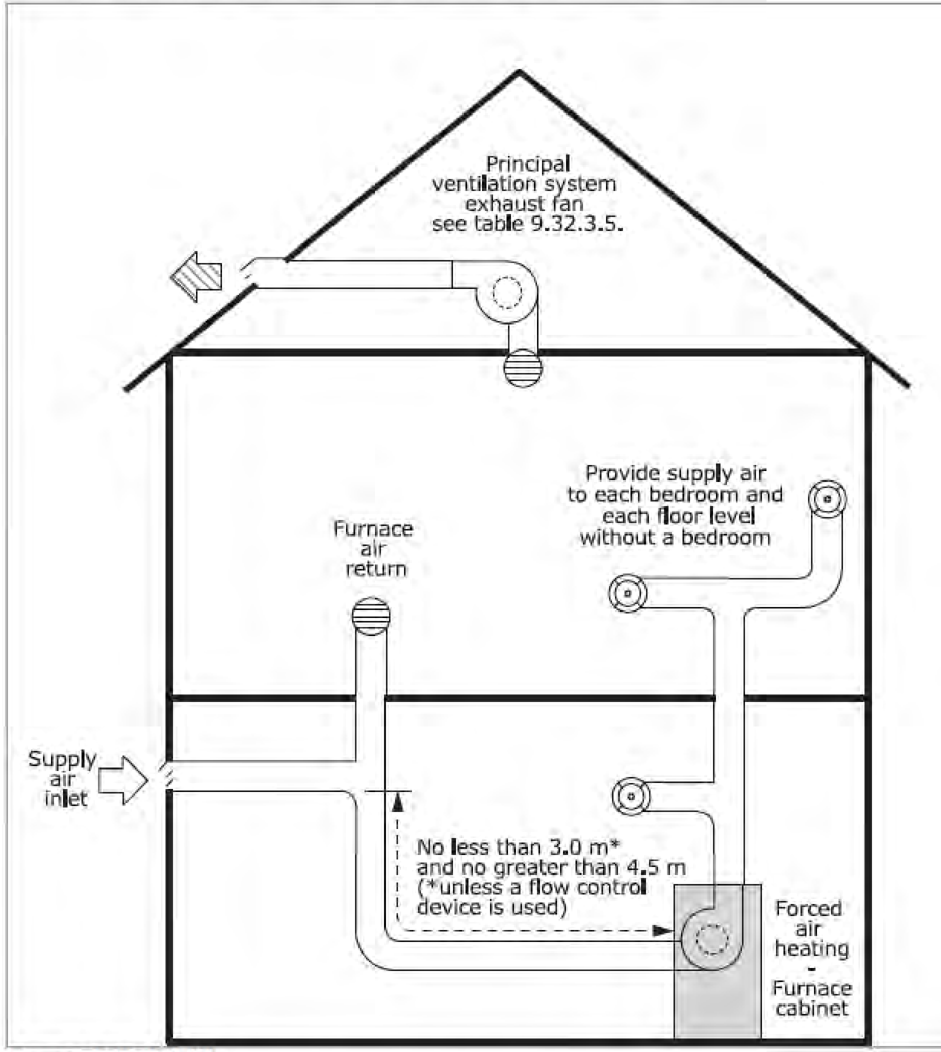


Figure 9.32.3.4.(2)

Forced-Air Heating System Supply Air Distribution

PRINCIPAL EXHAUST FANS

9.32.3.5. Principal Ventilation System Exhaust Fan

1) A principal ventilation system exhaust fan shall

a) run continuously, and

b) provide at least the air-flow rate specified in Table **9.32.3.5.**

Principal Ventilation System Exhaust Fan Minimum

Floor Area ft²	Minimum Air-flow Rate, cfm				
	Number of Bedrooms				
	0–1	2–3	4–5	6–7	>7
<1500	30cfm	45cfm	60cfm	75cfm	90cfm
1500–3000	45	60	75	90	105
3001–4500	60	75	90	105	120
4501–6000	75	90	105	120	135
6001–7500	90	105	120	135	150
>7500	105	120	135	150	165

Table 9.32.3.5.
Principal Ventilation System Exhaust Fan Minimum Air-flow Rate
Forming Part of Sentence 9.32.3.5.(1)

Floor Area, m^2	Minimum Air-flow Rate, L/s				
	Number of Bedrooms				
	0–1	2–3	4–5	6–7	> 7
< 140	14	21	28	35	42
140–280	21	28	35	42	49
281–420	28	35	42	49	56
421–560	35	42	49	56	64
561–700	42	49	56	64	71
> 700	49	56	64	71	78

VENTILATION REQUIREMENTS

9.32.3.6. Kitchen and Bathroom Exhaust Fans

1) An exhaust fan that provides at least the air-flow rate specified in Table **9.32.3.6.** shall be installed in

   a) **every kitchen**, and

   b) **every bathroom** or water-closet room, unless the bathroom or water-closet room is served by the principal ventilation system exhaust fan that complies with Article 9.32.3.5.

2) For the purposes of Sentence (1), the capacity rating of the exhaust fan shall be determined, based on air-flow performance at 50 Pa [0.2"wc] of external static pressure, in accordance with...[HVI or CSA standards]

VENTILATION REQUIREMENTS

Table 9.32.3.6
Kitchen/Bathroom Exhaust Fan Minimum Air-flow Rate

Room	Exhaust Rate cfm	
	Intermittent	Continuous
Kitchen	100	N/A
Bathroom	50	20

Note: Minimum Required Rates at 0.2 inches water column external static pressure (ESP).

Table 9.32.3.6.
Kitchen/Bathroom Exhaust Fan Minimum Air-flow Rate
Forming Part of Sentence 9.32.3.6.(1)

Room	Minimum Exhaust Fan Air-flow Rate, L/s	
	Intermittent	Continuous
Kitchen	47	N/A
Bathroom	23	9

VENTILATION REQUIREMENTS

9.32.3.8. Air Ducts

Note: per sentence 7), kitchen ducting to be **non-combustible**

Table 9.32.3.8.
Maximum Equivalent Duct Length [1], m
Forming Part of Sentence 9.32.3.8.(3)

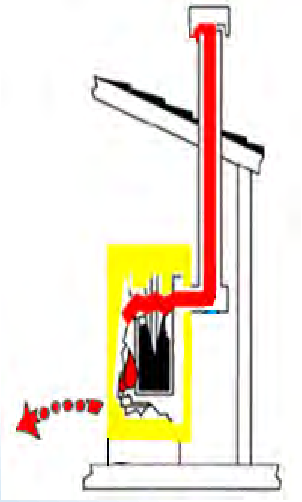
Flexible Duct						
Equivalent Diameter, mm (Cross Section Area for Rectangular Ducts, cm^2)	Fan Capacity, L/s					
	25	40	50	60	70	80
125 (123)	32	15	-	-	-	-
150 (177)	46	40	28	18	13	-
175 (240)	46	46	46	46	46	24
200 (314)	46	46	46	46	46	46
Rigid Duct						
Equivalent Diameter, mm (Cross Section Area for Rectangular Ducts, cm^2)	Fan Capacity, L/s					
	25	40	50	60	70	80
100 (79)	32	15	-	-	-	-
125 (123)	46	40	28	18	13	-
150 (177)	46	46	46	46	46	24
175 (240)	46	46	46	46	46	46

NAFFVA & DEPRESSURIZATION

9.32.4. Additional Protection Against Depressurization

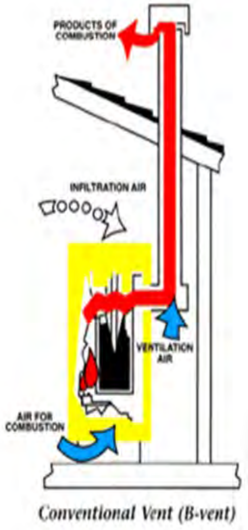
- Naturally Aspirating Fuel-Fired Vented Appliance (NAFFVA) relies on thermal buoyancy and can cause harm to the occupants if a strong negative pressure reverses the flue gas.

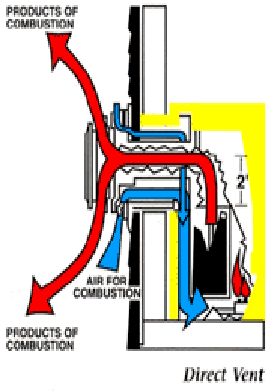
Negative Pressure from Kitchen Fan



Carbon Monoxide

Low Indoor Pressure





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VENTILATION CHECKLIST

2014 Amendment to Section 9.32 Ventilation

2 Ventilation Checklist 2—HRV Systems   SENTENCE 9.32.3.4 (3) & (4)

Use this checklist when a centrally ducted HRV (heat recovery ventilator) is used alone or in combination with a Forced Air Heating System to meet principal ventilation system requirements.

Civic Address 2014 North St, Surrey   Permit No.____

Climate Zone: 4   Number of Bedrooms **4** (A)   A bedroom is a room with an openable window (minimum dimensions apply), a closet and a closing interior door.

Total Floor area of living space **3750** ft² (B)

Total Interior Volume of Dwelling **32,500** ft³   Total volume includes all heated interior spaces (including crawlspace if heated).

.5 ACH (air changes/hr) = Volume x 0.5 ÷ 60 = **271** cfm (C)   Exhaust appliances exceeding .5 ACH may require make-up air.

1. Use the bedroom count (Box A above) and total square footage (Box B above) to determine the minimum principal Air Flow rate required by Table 9.32.3.5

Minimum Required Rate **90** cfm (D)

2. HRV Make ACME   Model H150

3. HRV Capacity: CFM @ 0.4 ESP. Box E must meet Box D requirement. **124** cfm (E)

4. List Exhaust Grilles Locations: 1 minimum @ 6 ft or higher from floor of uppermost level.

- Bath 1
- Bath 2
- Bath 3
- Kitchen
- Laundry

5. Required Kitchen and Bathroom Exhaust

If HRV used to meet all or part of Kitchen/Bathroom spot exhaust requirements list below.

ROOM	REQUIRED EXHAUST RATE Table 9.32.3.6	EXHAUST EQUIPMENT: Spot Exhaust Kitchen & Bath WALL/CEILING FANS: Fan Make & Model	CFM @ 0.2 ESP Manf. Rated	*Duct Sizing per Table 9.32.3.8.(3): Duct Dia (in Ø) rigid	flex	Max. Equiv. Length per table	Installed Equiv. Length	HRV Principal System CFM
Kitchen	100	Acme K500	525	10		100	40	25
Bath 1	50/20	Acme EF90	82		6	50	45	25
Bath 2	50/20	Acme EF70	63		6	50	50	25
Bath 3	50/20	Acme EF70	63	5		130	60	25
Laundry	n/a							24
							TOTAL (must = Box E)	124

* For fan capacities **exceeding** 175cfm in Table 9.32.3.8(3), follow manufacturer's installation instructions or use good engineering practice to size duct. See *Ventilation Guidelines* Appendix page 16-A, *Duct Sizing for Larger Fans*.

 Checklist 2, pg1of2

6. HRV Fresh Air Distribution (Choose a or b)

a) Supply Air from HRV direct connect to Return Air of a Forced Air Heating System:

- ☐ FA system fan and HRV fan continuous operation and
- ☐ FA system ducted to supply air to every bedroom and each floor level without a bedroom

b) Supply Air from HRV distributed independently

- ☑ Ducted to every bedroom and each floor level without a bedroom and
- ☑ HRV fan continuous operation

7. If Heated Crawlspace present, (Choose one)

- ☐ Minimum of one Forced Air System RA grille located in the crawlspace, OR
- ☐ No RA grille in crawlspace, choose ventilation Option 1, 2, or 3 per sentence 9.32.3.7 (2)

MAKE-UP AIR Requirements

1. NAFFVA (Naturally Aspirated Fuel Fired Vented Appliance) **present in dwelling unit?** (per Sentence 9.32.4.1)

- ☐ No, Omit Steps 2 & 3
- ☑ Yes, Proceed to Step 2

2. Exhaust Appliance present which exceeds Box C 0.5 ACH:

- ☐ No such appliance. Omit Step 3
- ☐ Yes, Commit to Depressurization Test (See CAUTION, TECA Vent Manual pg 24)
- ☑ Yes, Proceed to Step 3

3. Use Active Make-up Air for Exhaust Appliance. (Choose a or b)

Make-up Air Fan required: Exhaust Appliance Actual Installed Cfm 525

Fan Make Acme   Model M600   Make-up Air Fan Cfm 525

Duct diameter 10 inches   Fan Location Basement

☑ Fan interconnected with exhaust appliance fan.   Fan ducted to Kitchen

a) Active Make-up Air delivered to an Unoccupied Area first (not directly to room containing the appliance).

i) Tempering Required per 9.32.4.1.(4)(a):

Show calculation how make-up air will be tempered to at least 34°F (1°C) before entering unoccupied area.

Make-up Fan cfm____ X 1.08 X (34° F – ____ °F Winter Design Temp your location) / 3412 BTUH/kw = ____ (kw) Duct Heater

ii) Transfer Grill Required: Size 1 sq in of gross area per 2 cfm: Transfer grill size ____sq. in. Location ____

iii) Additional Tempering Required per 9.32.4.1.(4)(b) before transfer to occupied area: Show calculation and describe how make-up air will be further tempered to at least 54°F (12°C).

Make-up Fan ____cfm x 1.08 x (54° F – 34°F) / 3412 BTUH/kw = ____(kw) Heat from unoccupied area required to raise temp by 20°F

Tempered by: ____

OR b) Active Make-up Air delivered to an Occupied Area: Tempering Required. Show calculation how make-up air will be tempered to at least 54°F (12°C).

Make-up Fan cfm 525 x 1.08 x (54° F – 18 °F Winter Design Temp your location) / 3412 BTUH/kw = 5.98 (kw) Duct Heater

Installer Certification:

I hereby certify that the design and installation of the ventilation system complies with the 2012 B.C. Building Code, 2014 Section 9.32 Amendment.

Date JULY 18, 2024

Print Name TODD BACKUS

Signature TB

Company TECA

Phone 604-838-7511

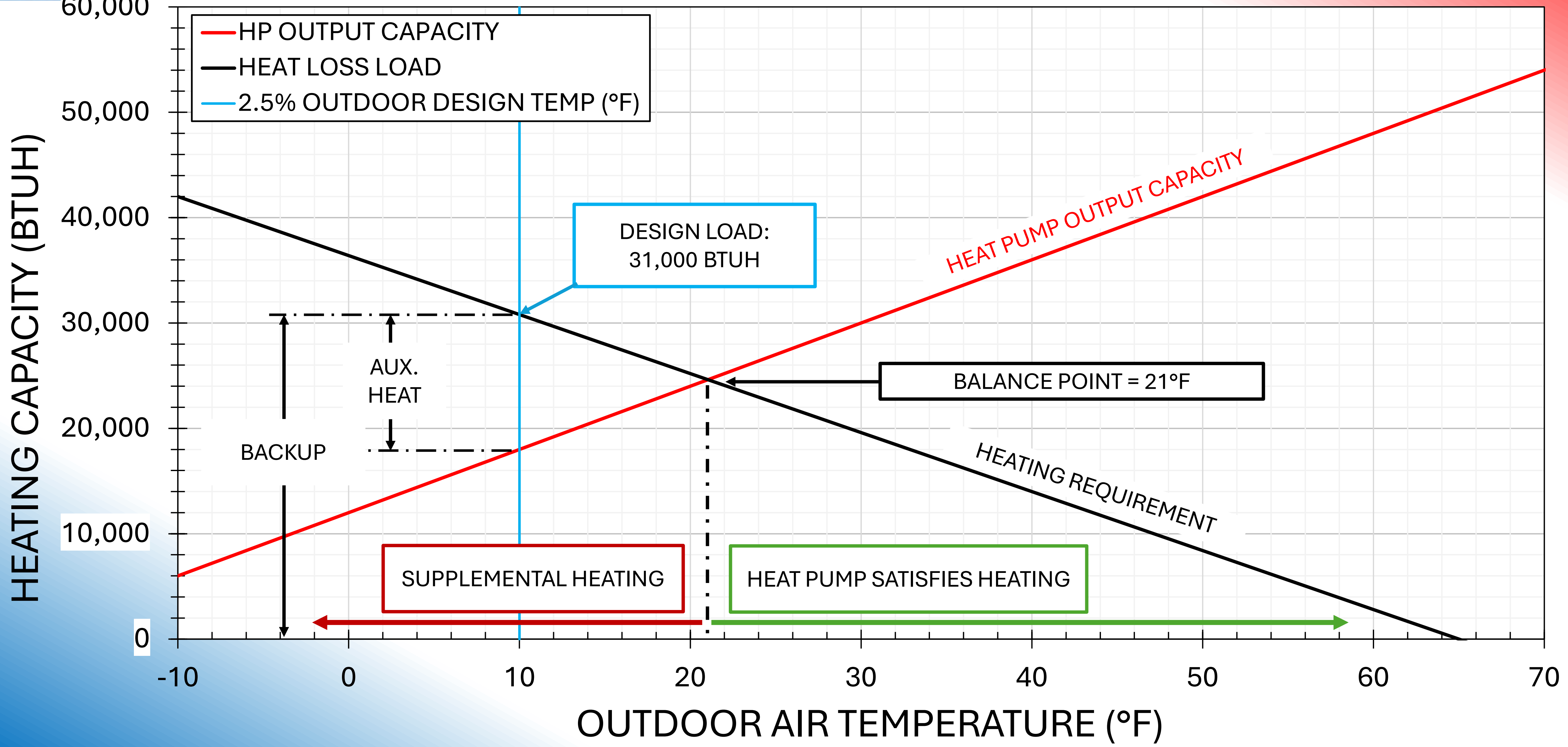
2012 TECA Ventilation Certification Stamp

Checklist 2, pg2of2

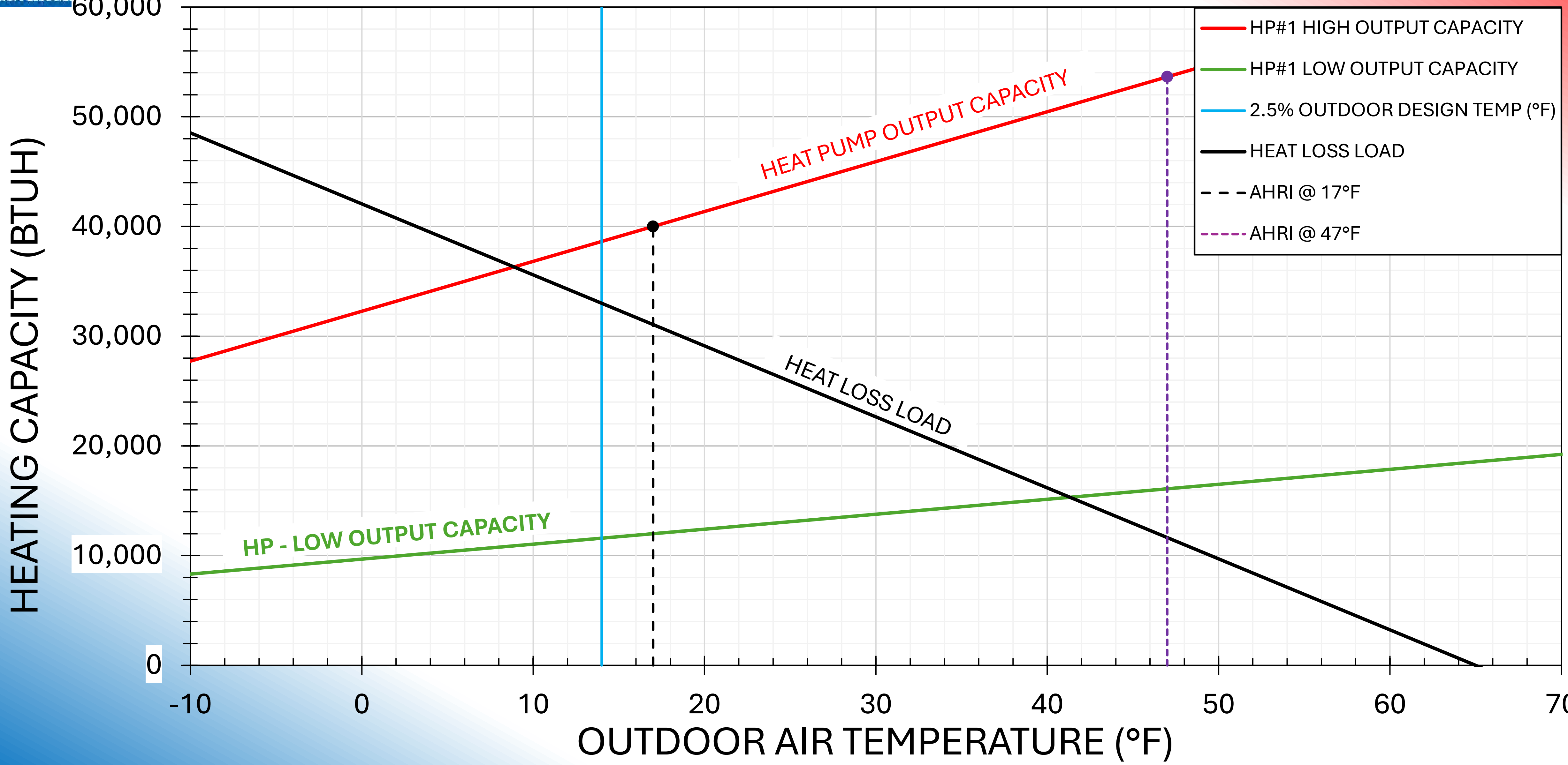
9.33 HEATING & AIR CONDITIONING

- Heating & Cooling Equipment to be sized using CSA F280-12 standard
  - NOTE: Equipment must be sized using design temperatures, **not** nominal values
- Design temperatures are prescriptive
- One room must be able to maintain 26°C

HEAT PUMP BALANCE POINTS



HEAT PUMP BALANCE POINTS



EQUIPMENT SELECTION

1 **MHPC Submittal Form**

Project Name__________ Date__________ Job # __________

Job Address __________ City__________ Permit #__________

Installer __________ Phone__________

1 **Load Calculation**

Heating Outdoor Design Temperature from CSA F-280 Heat Loss/Heat Gain Calculation (BOX A) — °F **A**

Cooling Outdoor Design Temperature from CSA F-280 Heat Loss/Heat Gain Calculation (BOX B) — °F **B**

Total Dwelling Heat Loss in BTUH from CSA F-280 Heat Loss/Heat Gain Calculation (BOX C) — BTUH **C**

Total Dwelling Heat Gain in BTUH from CSA F-280 Heat Loss/Heat Gain Calculation (BOX D) — BTUH **D**

2 **Heat Emitters Selection**

Select Heat Emitter, Heating Supply Water Temperature (BOX E) — °F **E**

☐Low temp. Convector / Radiator ☐Radiant Floor ☐Low temp. Fan coil ☐Pool /Snowmelt

Minimum zone load(heating) (BOX F) — BTUH **F**

Select Evaporator, Cooling Supply Water Temperature (BOX G) — °F **G**

☒Suitable Convector ☐Radiant Floor(caution!) ☐Fan coil **Minimum zone load(cooling)** (BOX H) — BTUH **H**

3 **Heat Pump Selection Criteria**

Use manufacturer specification sheets to select the heat pump and specify Heating and Cooling output (BOX I / J)

Heat Pump Capacity Control

☐ Single-Stage ☐ Multi-Stage ☐ Variable speed (inverter) ☐ Monobloc ☐ Split

Heating Output — BTUH **I** — BTUH Output @ Heating Design Temperature

A. Primarily based on the heating load (Heating Only) Yes ☐

1. Heating output meets the 100% of Total Dwelling Heat Loss (BOX C): Yes ☐
2. Heating output meets minimum 75% of Total Dwelling Heat Loss (BOX C): Yes ☐ Complete section 4

B. Primarily based on the cooling load (Heating and/or Cooling)

Cooling Output — BTUH **J** — BTUH Output @ Cooling Design Temperature

1. Cooling output meets the 100% of the Total Dwelling Heat Gain (BOX D) Yes ☐
2. Cooling output meets the 100% of Total Dwelling Heat Gain (BOX D) and minimum 75% of the Total Dwelling Heat Loss (BOX C) Yes ☐ Complete section 4
3. Cooling/Heating output meets the 100% of the Total Dwelling Heat Gain/Heat Loss (BOX D/C): Yes ☐

Make__________ Model__________

2 **MHPC Submittal Form**

4 **Supplementary Heating**

Heat Pump Balance Point (BOX K) — °F **K**

Heat Pump Heating Output at Balance Point from manufacturer specification sheets (BOX L) — Btu/h **L**

Required Supplementary Heat (BOX M) — Btu/h **M**

Heat Pump Heating Output at Balance Point______(Box M) minus Total Dwelling Heat Loss at Design Temperature______ (Box C) = Required Supplementary Heat (Box M)

Required Supplementary Heat (Box M) is ___% of Total Dwelling Heat Loss at Design Temperature (Box C)

Supplementary Heating device capacity (BOX N1,N2,N3) meets the Required Supplementary Heat (BOX M):Yes ☐

Gas Boiler ☐ — Btu/h **N1**

Electric Element ☐ — Kw **N2**

Electric Boiler ☐ — Kw **N3**

Supplementary Heat Controlled by Heat Pump ☐ External Control System ☐

Pipe Sizing Use Tables 1A, 1B and 1C in Appendix for pipe sizing

5 **Buffer Tank Selection**

Buffer Tank Sizing (BOX O1, O2, O3)

(Use Formula in Appendix for buffer tank sizing.)

Cooling buffer tank construction and insulation is condensation resistant: Yes ☐

Heating — Gal **O1**

Cooling — Gal **O2**

Heating/cooling — Gal **O3**

6 **Domestic Hot Water**

Any Domestic Water Heating: Yes ☐ Complete same calculation in section 8 for Domestic Heat Load (BOX P1, P2) — Btu/h **P1**

A. Preheat with Boost

Domestic preheat through hydronic buffer tank then boost (thru Tankless Heater) ☐ thru Storage Water Heater ☐ — Btu/h **P2**

B. Indirect Fired Heater with Top Up

1.Priority: Yes ☐ No ☐

2.Top up to 140°F (60°C): Yes ☐

Heat Pump ☐ Gas Boiler ☐ Electric Boiler ☐ Electric element ☐

7 **Heat Pump Circulator**

Manufactures minimum required flow rate — gpm

Required flow rate corrected for glycol — gpm **Q**

Built-in Circulator: Yes ☐

External Heat Pump Circulator: Yes☐ **Glycol system** Yes ☐

Total head corrected for glycol — Ft.hd **R**

Circulator Sizing

Heat Pump Flow Requirement (BOX Q & R)

Selected HP loop pipe diameter — Dia **S**

Primary Loop Circulator Sizing (BOX S & T)

Designed heat pump loop gpm — gpm **T**

Make__________ Model:__________ Speed#__________

Designed heat pump loop ft.hd. — Ft.hd **U**

3 **MHPC Submittal Form**

8 **Heat Pump Water Heater**

Minimum Domestic Demand: 1st Hour Draw (Box U)
(Use Table 5 HUD-FHA in Appendix for sizing information)

1st Hour Draw — Gal/hr **V**

Chosen Storage Capacity: (Box V)
(Use Table 5 HUD-FHA in Appendix for sizing information)

Storage Capacity — Gal **W**

1.Selected Storage Capacity ______(Box V) x 0.8 = Usable Storage (Box W) — Gal **X**

2.1st Hour Draw Gallons_____ (Box U) minus Useable Storage______ (Box W) = Shortage Gallons (Box X) — Gal **Y**

3.Shortage Gallons _____(Box X) x (8.33 x Temperature Rise_____) = Heat Pump Water Heater Capacity (Box Y) — BTUH **Z**

9 **System Summary & Schedule**

Heat Pump Guideline Drawing # _____ **AA**

Pump Schedule			
No.	Model	GPM	FtHd

Hydronic Emitter Load Summary			
System	Load (BTUH)	ΔT	Supply Temp (°F)
Low temp Convector /Radiator			
Radiant Floor			
Low temp. Fan coil			
Pool /Snowmelt			
Domestic			
Other			

HEAT PUMP:

Manufacture__________

Model__________

Cooling Load Summary			
System	Load (BTUH)	ΔT	Supply Temp (°F)
Fan coil			
Radiant Floor/Ceiling			

Designer Name__________(Print)

Designer Signature__________

Phone #__________

TECA Hydronics Design (Heat Pump) Certification # _____

Stamp

FORCED AIR DESIGN DOCUMENTS

HEAT GAIN Summary & CFM Distribution Worksheet

Q1st # ______ Date ______ Job # ______

Job Address BURNABY EXAMPLE

Completed by ______ PH ______

Company ______ Signature ______

STEP 1: Size Appliance on *Appliance Selection Worksheet* using **Minimum Installed System Cooling Capacity** from HLHG Results.

STEP 2: Enter Room & Floor in Column 1. Enter ***Room Cooling Load*** from the HLHG Results for each room. Add Column 2 to find ***Base Sensible Cooling*** and enter in **Box 1C.**

Cooling CFM Distribution Factor

STEP 3: For appliance sized on *Appliance Selection Worksheets*, **use the Cooling CFM** divided by Base Sensible Cooling Load (Box 1C).

Cooling CFM 883 / Box 1C 16321 BTUH = .0541 CFM/BTUH Box **2C**

Must be carried to 4 decimal places.

STEP 4: CFM per Room
Multiply Column 2 Room Heat Gain by the CFM Distribution Factor to determine the actual CFM required for cooling each room. Record in Column 4.

STEP 5: Compare the heating and cooling CFM. Record the larger of the heating or cooling CFM requirement in Column 5 on the *Heat Loss & CFM Summary Worksheet.*

Column 1: Room Name & Floor		Column 2: Room Heat Gain	X Column 3: CFM Dist Factor	= Column 4 (See Note): Room CFM
Basement A	1	912		49
Basement B	1	839		45
Basement C	1	1123		61
Liv/Entry	2	3033		164
Stairs	2	672		36
Kit/pantry/hall	2	1918		104
Bath	2	342		19
Dine/hall/closet	2	2368		128
			.0541 Box 2C	
Master	3	2244		121
Bed1/hall/closet	3	1497		81
Bed2/hall/closet	3	1027		56
Upper Bath	3	346		19
Base Sensible Cooling (BTUH)		16321	Box 1C	Total Cooling CFM: 883

Column 4 Note:

Column 4 **Room CFM** may be rounded ± 5% for individual run sizing.

HEAT LOSS Summary & CFM Distribution Worksheet

Q1st # ______ Date ______ Job # ______

Job Address BURNABY EXAMPLE

Completed by ______ PH ______

Company ______ Signature ______

STEP 1: Enter Room & Floor in Column 1. Enter Room Heat Loss from HLHG Results sheet in Column 2. Total Column 2 for **Base Dwelling Heat Loss** (Box 1H).

STEP 2: Enter **Ventilation Load** from HLHG Results. This is the load for a 4"Ø ventilation air duct or HRV tied into the furnace return air system.

= 3362.4 BTUH Box **2H**

Note for an HRV with dedicated supply, ventilation air will already be added into each room that was marked with a continuous airflow volume on HLHG Results page.

STEP 3: Total Dwelling Heat Loss for Appliance Selection on *Appliance Selection Worksheet*:

Box 1H + Box 2H = 26571.4 BTUH Box **3H**

STEP 4: Confirm Box 3H is equal to or larger than Minimum Required System Heating Capacity in HLHG Results.

Htg CFM Distribution Factor

STEP 5: For appliance sized on *Appliance Selection Worksheets* **use the larger CFM—either Heating CFM <u>or</u> cooling CFM.** Divide by the Base Dwelling Heat Loss (Box 1H).

Larger CFM 883 / Box 1H 23109 BTUH = .0382 CFM/BTUH Box **4H**

Must be carried to 4 decimal places.

STEP 6: For Column 4 **CFM per Room** Multiply Column 2 Room Heat Loss by the CFM Distribution Factor to determine

STEP 7: Complete Heat Gain Summary sheet. In Column 5 enter the larger of the heating or cooling CFM requirement for each room. Total Column 5 for the **Design CFM** that allows for rooms with a larger cooling than heating load.

Column 1: Room Name & Floor		Column 2: Room Heat Loss	X Col. 3: CFM Dist Fact	= Column 4: Room Htg CFM	and # Diffusers	Column 5: Larger of Htg or Clg CFM
Basement A	1	3228		123	2	123
Basement B	1	1779		68	1	68
Basement C	1	2410		92	1	92
Living/entry	2	3516		134	2	164
Stairwell	2	1426		54	1	54
Kit/pantry/hall	2	1394		53	1	104
Main Bath	2	324		12	1	19
Dine/hall/closet	2	1650		63	1	128
			.0382 Box 4H			
Master	3	3039		116	2	121
Bed1/hall/closet	3	1787		68	1	81
Bed2/hall/closet	3	1740		66	1	66
Upper Bath	3	816		31	1	31
Base Dwelling Heat Loss (BTUH)		23,109	Box 1H	883 Total Htg CFM		1051 Total Design CFM

thermal environmental comfort association

F.A. SYSTEM DRAWINGS

Supply Air Worksheet for Conventional System: 0.3"wc ESP

Q1st # ________ Date ______________ Company ______________

Job # ______ Job Address **BURNABY EXAMPLE**

Completed by ______________ Signature ______________

PH ______________

Heatloss Method Used: ☒ Room-by-Room or ☐ Block Load—Flr-by-Flr or Whole House

System Sketch
Show all Trunks & Branch Runs

Floor level	Trunk	Register	Room	Trunk Sizing SubTotals	4"Ø 4 ftg (35)	4"Ø 6 ftg (30)	4"Ø 7 ftg (25)	5"Ø 4 ftg (65)	5"Ø 6 ftg (55)	5"Ø 7 ftg (45)	6"Ø 4 ftg (100)	6"Ø 6 ftg (90)	6"Ø 7 ftg (75)	7"Ø 4 ftg (160)	7"Ø 6 ftg (135)	7"Ø 7 ftg (110)
3	Trunk #1	S3	Bedrm 2	66								66				
3		S2	Bedrm 1	147								81				
2		S7	Main Bath	166	19											
1		S14	BSMT C	258							92					
1		S13	BSMT B	326							68					
			Trunk #1 size to Table ST5-6 326 cfm													
	reducer															
2	Trunk #2	S12	Kitchen	454										104		
2		S8	Dining	558										128		
3		S4	Upper Bath	589					31							
3		S1	Stairs	643					54							
3		S6	Master Bedrm	703								60				
			Trunk #2 size to Table ST5-6 703 cfm													
	reducer															
2	Trunk #3	S11	Living	757				54								
1		S16	BSMT A	820				63								
			Trunk #3 size to Table ST5-6 820 cfm	820												
	90°															
			Trunk #4 to Table ST5-6 231 cfm	231												
3	Trunk #4	S5	Master Bedrm	231								61				
2		S10	Living	170				54								
1		S15	BSMT A	116				60								
2		S9	Living	56				56								
			Total CFM	1051	19			287	85		160	268		232		

← Add these column totals for Total CFM

SA Trunk Duct Sizes

#1	10 x 8	#4	8 x 8
#2	18 x 8	#5	
#3	20 x 8	#6	

Conventional (.3"wc ESP) Return Air System

Heatloss Method Used:
☒ Room-by-Room
☐ Block Load—Flr-by-Flr or Whole House

JOB #: __________ Address __________

BURNABY EXAMPLE

Date __________ Completed by __________

TECA# __________ Signature __________

Show all trunks and branches.

SKETCH

Wall construction	2 x 4	2 x 6	2 x 4	2 x 6	2 x 4	2 x 6
Return Air Grille Size	14 x 6	14 x 8	24 x 6	24 x 8	30 x 6	30 x 8
Maximum CFM capacity (Always enter actual cfm returned per Column 1)	200	260	350	460	425	580
(returns)			283	353	415	
Column totals			283	353	415	
	a	b	c	d	e	f

Supply Register Summary per RG

upper floor
RG1
S1 54
S2 81
S3 66
S4 31
S5 61
S6 60
353

main floor
RG2
S7 19
S8 128
S9 56
S10 54
S11 54
S12 104
415

basement
RG3
S13 68
S14 92
S15 60
S16 63
287

RG1
Trunk #1 size to RT-2
#1
RA Drop
#2
Trunk #2 size to RT-2
RG2
Trunk #3 size to RT-1
#3
RG3

Sub-totals for Trunk Sizing: 353; 698 ↑ 415 ↑ 283

1051 = Box B

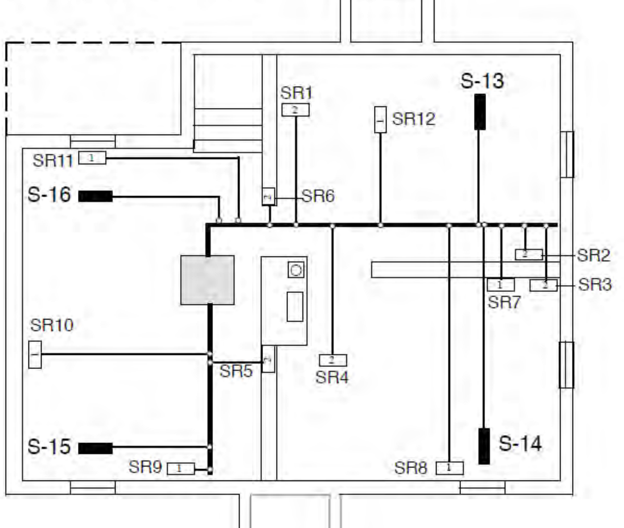
a+b+c+d+e+f = 1051 CFM Box B

RA Trunk Duct Sizes

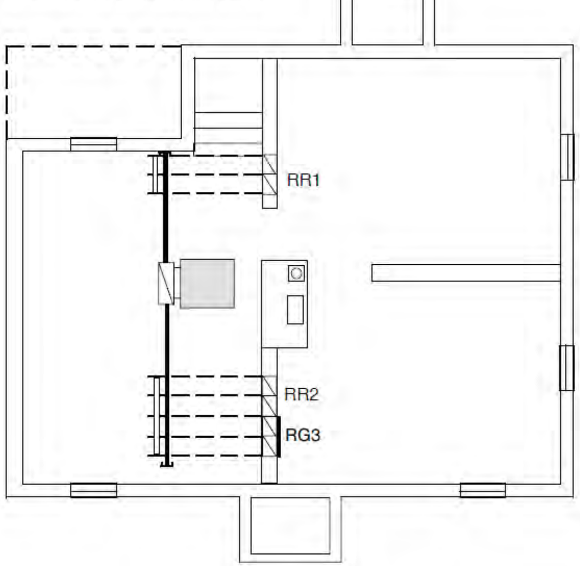
#1	10 x 8	#3	8 x 8
#2	18 x 8	#4	

Return Air Drop Size: Sized to RT3 24 X 10

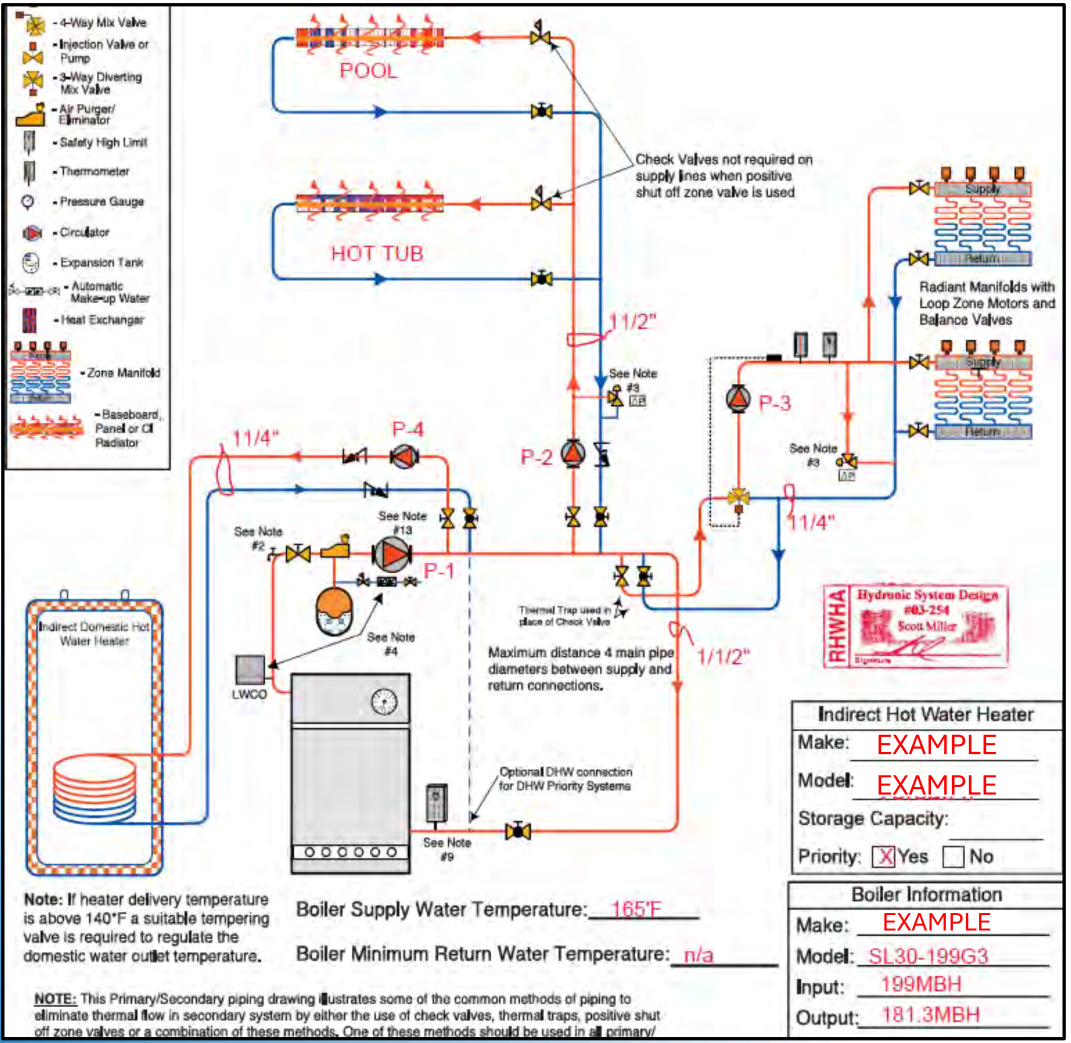
Basement & Foundation Plan

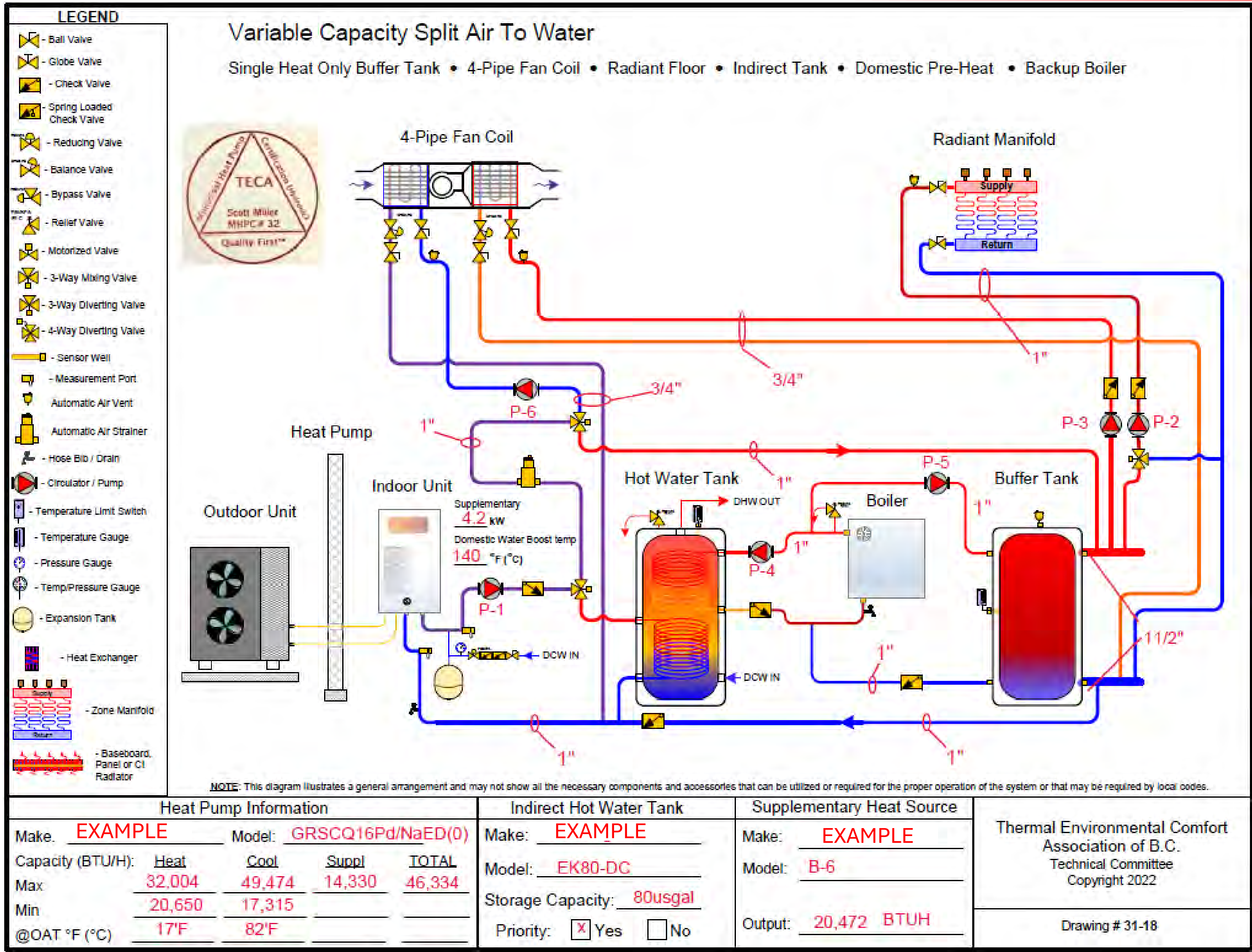


Basement & Foundation Plan



HYDRONIC SYSTEM DRAWINGS





COMMISSIONING CHECKLIST

HEAT PUMP COMMISSIONING REPORT[1]

Customer's Name:		**Address:**		
Heat Pump Equipment Information				
Manufacturer:		Model#	Outdoor Unit# Indoor Unit#	
Heating capacity (BTU/h)		HSPF		
Cooling capacity (BTU/h)		EER (35°C)		
Design air flow (CFM)		SEER		
Variable speed HP compressor	YES / NO	Thermal balance point (°C)		
Duct design static pressure (IWC)				
Existing Heating System Being Replaced		Electric forced air w/out AC Electric forced air w/ AC Electric zonal Air-source heat pump Natural gas furnace Other non-electric heating: ___________		
Supplemenary/Backup Heating System		Electric forced air w/out AC Electric forced air w/ AC Electric zonal Natural gas furnace Other non-electric heating: ___________		
All tests performed in Test Only/Check Charge mode				YES / NO / NA
External Static Pressure Test and Airflow				
Outdoor Air Temperature (°C)				
Test performed in heating or cooling mode?		Heating (if ≤18°C) / Cooling (if >18°C)		
Unit of Pressure Used		Supply Static Pressure		
Return Static Pressure		External Static Pressure		
Compressor suction pressor		Compressor head pressure		
Airflow at Evaporator (CFM)		Measurement method used	Trueflow/ Fan Curve / Temperature split / Other__________	

[1] Installation of air-source heat pumps and air conditioners, CSA Standard C273.5-11 and Performance Tested Comfort Systems (PTCS) Air-Source Heat Pump Form

Refrigerant Charge Test			
Heating Mode		**Cooling Mode**	
Supply Air Temperature (SAT)		Discharge Pressure	
Return Air Temperature (RAT)		Discharge Temperature (DT)	
Temperature Split (SAT – RAT)		Liquid Line Temperature (LLT)	
Expected Temp Split from Performance table		Sub Cooling (DT – LLT)	
Controls			
Is the control system an Integrated Control?		Yes / No	
Control system make and model		Manufacturer: Model:	
Compressor Low Ambient Lockout Control Setting at 3°C or less?		Yes No installed/Disabled Non-electric backup No	
Supplementary/auxiliary heat lockout has been set to:		2°C <2°C	
Power Draw			
Outdoor temperature into Outdoor unit		Outdoor unit power (A)	
Indoor dry bulb temp. into indoor coil		Fan motor power (W)	
Indoor wet bulb temp. into indoor coil		Total unit power (W)	
Temperature of suction line		Temperature of liquid line	
Duct Leakage (applicable for Ducted Systems only)			
Test method used	Duct Blaster / Blow Dorr Subtraction / Other: ______________		
Exiting system duct leakage (CFM)		Leakage % reduction [(Existing – Post)/Existing]	
Post installation duct leakage (CFM)		Total % leakage (Post/Design)	
Notes:			
The ASHP is designed and installed accordance with CAN/CSA C273.5 and other applicable codes and standards.			
Installer's Signature:		**Date:**	
Installer's Full Name:		**Company Name:**	

HOME PERFORMANCE STAKEHOLDER COUNCIL

HPCN HVAC Registration Requires Training:

- HLHG Certification
- Principals of Moving Air
- House as a System (HPSC)

HOME PERFORMANCE STAKEHOLDER COUNCIL

HPCN membership required for many rebates

https://guides.co/g/updated-home-performance-contractor-network/231461

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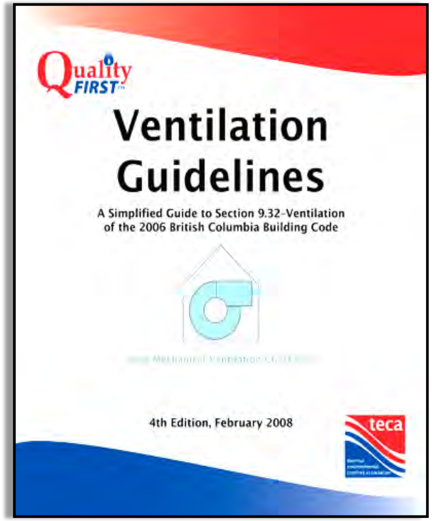
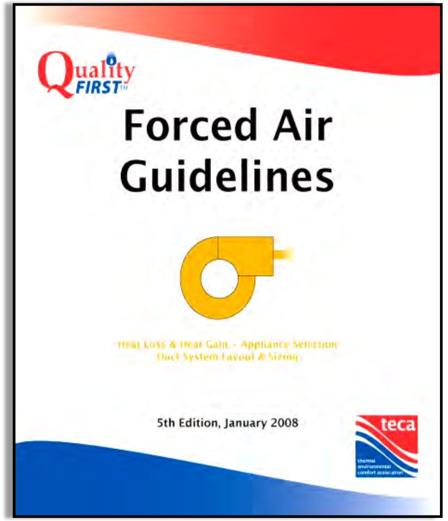
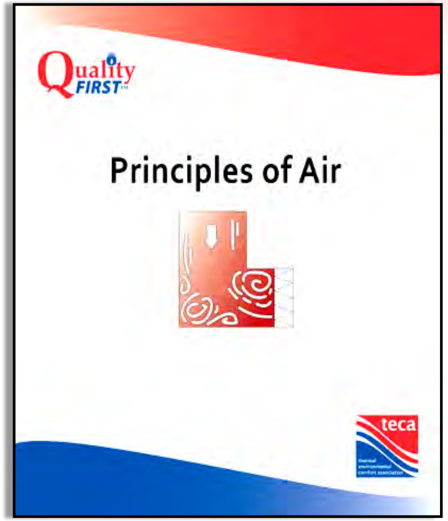
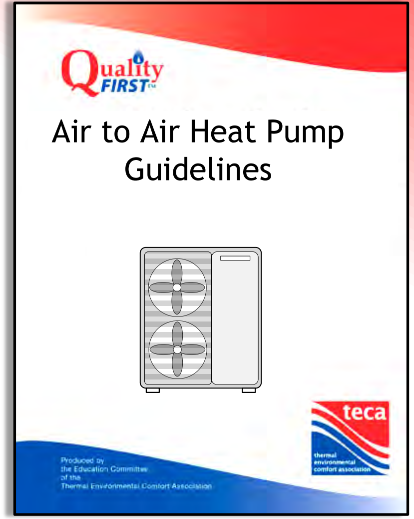
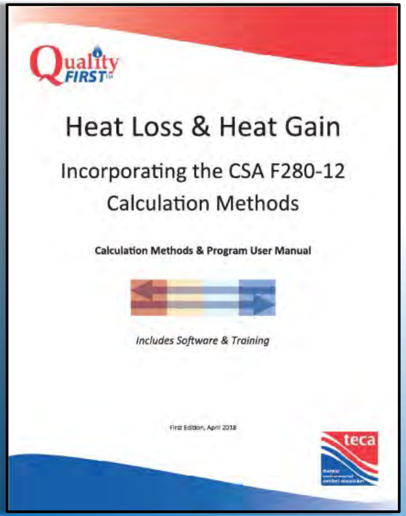
TECA COURSES

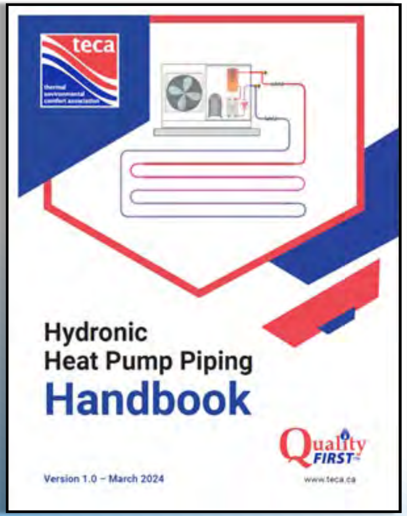


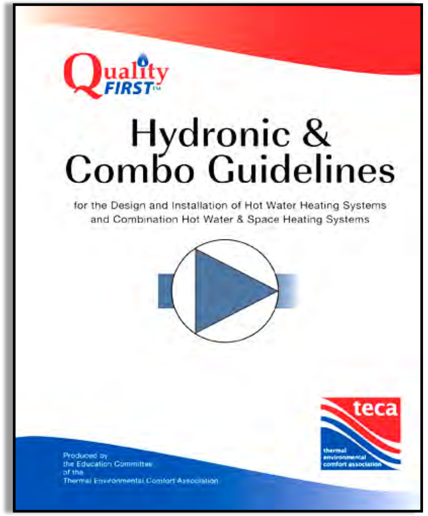


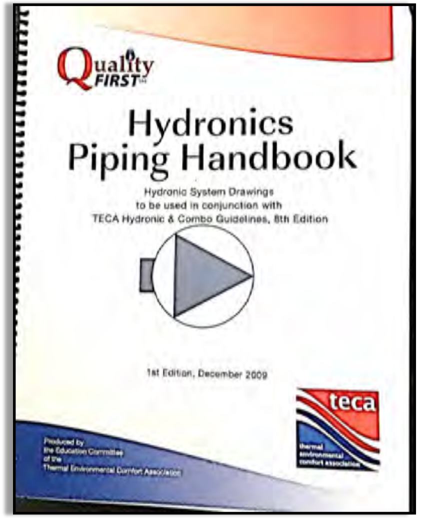












QUESTIONS & COMMENTS?

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email: tbackus@teca.ca

END