Sunshine Coast Regional District
Building Division Policy

Heat Loss and Ventilation Checklists for all new buildings.

February 1st, 2010

Subject: Requirements to provide ventilation check list, heat loss calculations, appliance selection, supply and return duct layout, hydronic loop layout, and/or electric heating layout for all buildings

Policy: With the increasing complexity of buildings and ever increasing Code requirements towards energy efficiency of buildings, it has become necessary to prove out the design of heating systems for all buildings issued permits after March 1st 2010.

This policy will apply to all buildings for which permits are issued after April 1st 2010, but does not apply to the following structures:

- Garages and accessory buildings.
- Sheds and storage buildings
- Greenhouse structures on residentially zoned property.

Residential Contractors and Homeowner Builders will be required to supply a ventilation checklist and heat loss analysis, heating appliance selection and duct layout on or before the Framing Inspection to the Building Inspector.

Buildings of other than one and two family use will require a design by a Registered Professional.

Particulars of these checklists will change depending on the type of heat used, but typically in a forced air heating system a heat loss sheet, heating appliance selection sheet and duct layout will be required. (***See package attached)***

All heat loss and ventilation requirements for buildings must follow either:

- The prescriptive requirements of the BCBC for Part Nine structures for heating and ventilation as amended from time to time.
- A computer modeling approach acceptable to the Building Inspector to demonstrate alternative compliance, or,
- An ASHRAE 90.1 Energy Usage and Heat Loss analysis submitted by a Registered Professional.

Heating options are often, (but not limited to), the following:
**(Solid fuel burning is not an acceptable primary source of heating)*

1. Forced Air
    a. Gas fired, oil fired
    b. Electric
    c. Heat pump with backup
    d. Geothermal
2. Electric
    a. Baseboard
    b. Forced Air
3. Hydronic
    a. Gas fired
    b. Electric
    c. Solar with backup
4. Geothermal
    a. Single source forced air
    b. Combination units (single source with backup)
5. Solar hot water
    a. Solar hot water hydronic single source
    b. Solar hot water with backup

In all cases it will be necessary to determine the total heat loss for the building and provide calculations by way of a heat loss form included in your building permit package, or other suitable means acceptable to the building inspector to demonstrate heat available is equal or greater than the heat losses of the building design.

(Some sample forms are provided in your Building Permit packages)

This process is augmented by the requirements of the Building Code to demonstrate Ener-guide compliance as we move forward in to 2012 and beyond.

It may also be required that owners/builders will need an energy audit also involving a fan door test to achieve the ener-guide rating at the time of final inspection, hence providing an ener-guide certificate with an energy rating in order to issue occupancy.

It would be well advised to involve the services of an energy consultant early on in the design of the building in order to guarantee the outcomes required for future occupancy issuance.

A Mechanical Ventilation Checklist A—Non-Distributed

Use this checklist with **Non-Distributed Systems** such as those usually found in dwellings with **electric or hot water radiant or baseboard heating systems or** where duct systems do not distribute ventilation air.

Civic Address_____ Permit No._____

Number of Bedrooms		(A)	A bedroom is a room with an openable window (minimum dimensions apply), a closet and a closing interior door.
Total Interior Volume of Dwelling	ft³		Volume must include joist space.
.5 ACH (air changes/hr) = Volume x 0.5 ÷ 60 =	cfm	(B)	Exhaust appliances exceeding .5 ACH may require make-up air.

1. Principal Fan

a) Exhaust Rate: Use the bedroom count from Box (A) above and Table 9.32.3.3.A. to determine Minimum Rate. Maximum Rate of 110 cfm if NAFFVA/Radon present.

The Principal Exhaust Fan will be controlled automatically with an interval timer OR run continuously.

Minimum required rate: **Interval Timer** **Continuous**

cfm (C) cfm (D)

b) Principal Fan CFM & Sone Rating:

Make_____ Model_____

cfm (E)

Box E Maximum allowed is **110 cfm** if Make-up Air Required in Step 4.

Sones: Interval _____ Continuous _____
Maximum rating: Interval Timer 1.5 Sones Continuous 1 Sone

Fan Location: _____

c) Principal Fan Duct Size: Use actual fan cfm in Box E above and Table 9.32.3.9.

Fan Duct size: _____ inches. Duct type: ___Smooth ___Flex

2. Required Kitchen and Bathroom Exhaust Fans:

Room	Fan Make & Model	Fan CFM		Duct Diameter (in) Table 9.32.3.9*	
		Code Req'd Min. @.2"W.C. per Table 9.32.3.3.B	actual Fan CFM @.2"W.C. per Manf. Rating	Smooth	Flex

* For fan capacities **exceeding** Table 9.32.3.9, follow manufacturer's installation instructions or use good engineering practice to size duct. See *Ventilation Guidelines* Appendix page 24-A.

Checklist A1

3. NAFFVA (Naturally Aspirated Fuel Fired Vented Appliance) **and/or Radon Gas present in dwelling unit?**

☐ **Yes, Proceed to Step 4 & 5** ☐ **No**, Omit Steps 4 to 8.

4. Passive Make-Up Air Duct for Principal Fan: Use the Box E installed cfm and Table 9.32.3.8.

Make-up air duct diameter_____inches. Location _____

5. Exhaust Appliance present which exceeds Box B 0.5 ACH:

☐ **Yes, Proceed to Step 6.** ☐ **No** such appliance. Omit Steps 6 to 8.

6. No radon risk and only NAFFVA present is solid fuel burning (e.g. wood, pellet):

☐ **Yes,** Omit Step 7 & 8 ☐ **No, Proceed to Step 7 or 8**

7. Use **Passive Make-up Air** for Exhaust Appliance with actual installed exhaust rate of **126 cfm or less:**

Appliance Cfm _____ **Passive Make-up Air Duct** Sized to Table 9.32.3.8: _____inches

8. Use **Active Make-up Air** for Exhaust Appliance with actual installed exhaust rate of **more than 126 cfm.**

Make-up Air Fan required: ***Exhaust Appliance Cfm** _____

Fan Make _____ Model _____ **Fan Cfm** _____

*Must equal actual installed exhaust rate of appliance.

Duct diameter _____inches

Fan Location _____ Fan ducted to _____

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

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

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

_____

Transfer Grill Required: Size to Table 9.32.3.8 (or 1 sq in of gross area per 2 cfm):

Transfer grill size _____ sq. in. Location _____

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).

_____

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

_____

_____

Installer Certification: Date _____

I hereby certify that the design and installation of the ventilation system complies with the 2006 B.C. Building Code.

Print Name_____ **2006 TECA Ventilation Certification Stamp**

Signature_____

Company_____

Phone _____

Checklist A2

B

Mechanical Ventilation Checklist B—Distributed

Previously Checklist C (per former 1998 BCBC)

This Checklist is for use with **forced air heating systems** where the heating duct system distributes ventilation air.

Civic Address_____ Permit No._____

Number of Bedrooms		(A)	A bedroom is a room with an openable window (minimum dimensions apply), a closet and a closing interior door.
Total Interior Volume of Dwelling	ft³		Volume must include joist space.
.5 ACH (air changes/hr) = Volume x 0.5 ÷ 60 =	cfm	(B)	Exhaust appliances exceeding .5 ACH may require make-up air.

1. Principal Fan

a) Exhaust Rate: Use the bedroom count from Box (A) above and Table 9.32.3.3.A. to determine Minimum Rate. (Maximum Rate of 110 cfm if NAFFVA/Radon present.)

The Principal Exhaust Fan will be controlled automatically with an interval timer OR run continuously.

Minimum required rate: **Interval Timer** cfm (C) **Continuous** cfm (D)

b) Principal Fan CFM & Sone Rating:

Make_____ Model_____ cfm (E)

Box E Maximum allowed is **110 cfm** if Make-up Air Required in Step 4.

Sones: Interval _____ Continuous _____

Maximum allowed: Interval timer 1.5 sones; Continuous 1 sone

Fan Location: _____

c) Principal Fan Duct Size: Use actual fan cfm in Box E above and Table 9.32.3.9 for Duct.

Fan Duct size: _____ inches. Duct type:___Smooth___Flex

2. Required Kitchen and Bathroom Exhaust Fans:

Room	Fan Make & Model	Fan CFM		Duct Diameter (in) Table 9.32.3.9*	
		Code Req'd Min. @.2"W.C. per Table 9.32.3.3.B	actual Fan CFM @.2"W.C. per Manf. Rating	Smooth	Flex

* For fan capacities **exceeding** Table 9.32.3.9, follow manufacturer's installation instructions or use good engineering practice to size duct. See *Ventilation Guidelines* Appendix page 24-A.

Checklist B1

3. NAFFVA (Naturally Aspirated Fuel Fired Vented Appliance) **and/or Radon Gas present in dwelling unit?**

☐ **Yes, Proceed to Step 4 & 5** ☐ **No**, Omit Steps 4 to 8.

4. Active Make-Up Air Duct for Principal Fan: Per Sec 9.32.3.8. (2) (b) (ii & iii) Install a 4"Ø outdoor air duct into the furnace return air plenum not more than 15ft (unless a flow control device is used) or less than 10ft from the furnace cabinet. In locations with winter design temperature less than –10° C, this duct must have a motorized damper interconnected with principal ventilation air fan. Damper make _____ Voltage_____

5. Exhaust Appliance present which exceeds Box B 0.5 ACH:

☐ **Yes, Proceed to Step 6.** ☐ **No** such appliance. Omit Steps 6 to 8.

6. No radon risk and only NAFFVA present is solid fuel burning (e.g. wood, pellet):

☐ **Yes,** Omit Steps 7 & 8 ☐ **No, Proceed to Step 7 or 8**

7. Use **Passive Make-up Air** for Exhaust Appliance with actual installed exhaust rate of **126 cfm or less:**

Appliance Cfm _____ **Passive Make-up Air Duct** Sized to Table 9.32.3.8: _____inches

8. Use **Active Make-up Air** for Exhaust Appliance with actual installed exhaust rate of **more than 126 cfm.**

Make-up Air Fan required: ***Exhaust Appliance Cfm** _____

Fan Make _____ Model _____ **Fan Cfm** _____

*must equal actual installed exhaust rate of appliance.

Duct diameter _____inches

Fan Location _____ Fan ducted to _____

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

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

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

_____

ii) **Transfer Grill Required:** Size to Table 9.32.3.8 (or 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).

_____

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

_____

Installer Certification:

Date _____

I hereby certify that the design and installation of the ventilation system complies with the 2006 B.C. Building Code.

Print Name_____ **2006 TECA Ventilation Certification Stamp**

Signature_____

Company_____

Phone _____

Checklist B2

C Mechanical Ventilation Checklist C—Distributed or Non-Distributed

Use this checklist when a centrally ducted exhaust ventilation systems such as an HRV (heat recovery ventilator or a CEV (central exhaust ventilator) is used to meet principal fan requirements.

Civic Address_____ Permit No._____

Number of Bedrooms		(A)	A bedroom is a room with an openable window (minimum dimensions apply), a closet and a closing interior door.
Total Interior Volume of Dwelling	ft^3		Volume must include joist space.
.5 ACH (air changes/hr) = Volume x 0.5 ÷ 60 =	cfm	(B)	Exhaust appliances exceeding .5 ACH may require make-up air.

1. Use the bedroom count from Box (A) above and Table 9.32.3.3.A. to determine the minimum Principal Exhaust Rate provided by the system.

Minimum Required Rate: cfm (C)

2. Equipment: Make_____ Model _____

HRV or CEV Capacity: ☐ CFM @.4"W.C. or
☐ CFM@ .3"W.C.—main trunks must be oversized by 1"Ø to Table 9.32.3.9 sizes cfm (D)

3A. HRV—The fresh air from the HRV is delivered using:

a) ☐ dedicated ducted fresh air duct system OR **b)** ☐ integrated with the forced air heating system

3B. Continuous CEV only: ☐ One Speed OR ☐ Two speed: Equipment set at fan speed setting ☐ Low OR ☐ High speed.

CEV Continous Rate cfm (E)

Box E must meet Minimum Box C requirement AND, if NAFFVA dwelling, not exceed 110 Cfm per 9.32.3.3.(2).

4. Required Kitchen and Bathroom Exhaust:

ROOM	EXHAUST RATE Required per Table 9.32.3.3.B	EXHAUST EQUIPMENT				
		Additional WALL/CEILING FANS				HRV/CEV
		Make & Model	CFM@.2" Manf. Rated	*Duct Dia (in) smooth	*Duct Dia (in) flex	Exhaust CFM

* Use Table 9.32.3.9. For fan capacities **exceeding** Table 9.32.3.9, follow manufacturer's installation instructions or use good engineering practice to size duct. See *Ventilation Guidelines* Appendix pg 24-A.

TOTAL

Checklist C1

5. NAFFVA (Naturally Aspirated Fuel Fired Vented Appliance) **and/or Radon Gas present in dwelling unit?**

☐ **Yes, Proceed to Step 6 if CEV or Step 7.** ☐ **No**, Omit Steps 6 to 10.

6. CEV only—Make-Up Air Duct for Continuous Principal Fan: Choose (a) or (b) and proceed to Step 7.

☐ **a) Non-Distributed system—Passive make-up air duct:** Use Box E installed cfm and Table 9.32.3.8.

Make-up air duct diameter_____inches. Location _____

☐ **b) Distributed system—Active make-up air duct:** Install a 4"Ø outdoor air duct into the furnace return air plenum not more than 15ft (unless a flow control device is used) or less than 10ft from the furnace cabinet.

Damper make _____ Voltage_____

7. Exhaust Appliance present which exceeds Box B —0.5 ACH:

☐ **Yes, Proceed to Step 8.** ☐ **No** such appliance. Omit Steps 8 to 10.

8. No radon risk and only NAFFVA present is solid fuel burning (e.g. wood, pellet):

☐ **Yes,** Omit Steps 9 & 10. ☐ **No, Proceed to Step 9 or 10.**

9. Use **Passive Make-up Air** for Exhaust Appliance with actual installed exhaust rate of **126 cfm or less:**

Appliance Cfm _____ **Passive Make-up Air Duct** Sized to Table 9.32.3.8: _____inches

10. Use **Active Make-up Air** for Exhaust Appliance with actual installed exhaust rate of **more than 126 cfm.**

Make-up Air Fan required: ***Exhaust Appliance Cfm** _____

Fan Make _____ Model _____ **Fan Cfm** _____

Duct diameter _____inches *must equal actual installed exhaust rate of appliance.

Fan Location _____ Fan ducted to _____

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

i) **Tempering Required per 9.32.4.1.(4)(a):**
Show calculation & describe how make-up air will be tempered to at least 34°F (1°C) before entering unoccupied area.

_____

ii) **Transfer Grill Required:** Size to Table 9.32.3.8 (or 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).

_____

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

_____

Installer Certification: Date _____

I hereby certify that the design and installation of the ventilation system complies with the 2006 B.C. Building Code.

Print Name_____ **2006 TECA Ventilation Certification Stamp**

Signature_____

Company_____

Phone _____

Checklist C2

Code Sizing Tables Converted to Imperial Measurements

Table 9.32.3.3.A
Principal Exhaust Fan Ventilation Rate

Number of Bedrooms	**Minimum Ventilation Rate** CFM
1	30
2	45
3	60
4 or more	75

A room is considered a bedroom if it has
1) a window that opens to at least
   a) 15 inches in width or height and
   b) 3.8 sq ft in area,
2) a closet and,
3) an interior door which closes.

All rates at 0.2" w.c. static pressure.
Maximum Ventilation Rate of 110 cfm applies if NAFFVA or Radon present, i.e. if Make-up Air Required for the Principal Fan.

Table 9.32.3.3.B
Bathroom/Kitchen Exhaust Ventilation Rate

Room	Exhaust Rate* CFM	
	Intermittent	Continuous
Kitchen	80	N/A
Bathroom	50	20

Minimum Required Rates @ 0.2" w.c. static pressure

Table 9.32.3.8.

Passive Make-up Air Opening Size		
Max. Ventilation Rate Controlled Automatically or Provided Continuously CFM	**Min. Make-Up Air Duct**	
	Vent Area In^2	**Vent Diameter** Inches Ø
17	7	3
25	10	4
32	13	4
36	15	5
42	18	5
53	22	5
63	26	6
74	31	7
84	35	7
95	39	7
105	44	8
116	48	8
126	52	9

Table 9.32.3.9

Minimum Exhaust Duct Size for Wall or Ceiling Exhaust Fan		
Max. Exhaust Fan Ventilation Rate Cfm	**Min. Exhaust Duct Diameter** Inches Ø	
	Smooth Duct	**Flex**
21	3	4
53	4	5
95	5	6
147	6	7

9.32.3.9. Exhaust and Make-up Air Ducts

3) Where a [ventilation] *exhaust duct* passes through or is located adjacent to an unheated space, the duct shall be **insulated** to not less than RSI 0.75 [R4].

4) Where a ventilation air *supply duct* passes through a heated space the duct shall be **insulated** to not less than RSI 0.75 [R4] and provided with an effective **vapour barrier.**

5) Where an exhaust duct exceeds 30 m [90ft] in total equivalent length, using an equivalent length of 10 m [30ft] for the exterior hood and 3 m [9ft] for each 90 degree elbow, the duct shall be increased to the next diameter.

Per 2006 BCBC 9.32.3.8.(5): Systems or ducts designed to provide combustion and/or dilution air for fuel burning appliances shall not be used to supply make-up air for ventilation systems.

B.C. Gas Code B-149 [Passive]

Combustion/Dilution Air Requirements			
TABLE 7.2.2A Combustion/Dilution Air Requirements for Appliances Having Draft Control Devices When the combined Input is up to and including 400,000 Btuh (120kW) and the Structure Complies with 5.2.1 (a) or (b)		TABLE 7.2.2B Combustion Air Requirements for Appliances NOT having Draft Control Devices When the combined Input is up to and including 400,000 Btuh (120kW) and the Structure Complies with 5.2.1 (a) or (b)	
Total Input of Appliances* Thousands of BTUH	Acceptable Approximate Round Duct Equivalent** Diameter in Inches	Total Input of Appliances* Thousands of BTUH	Acceptable Approximate Round Duct Equivalent** Diameter in Inches
25	3	25	2
50	3	50	2
75	4	75	3
100	4	100	3
125	5	125	4
150	5	150	4
175	6	175	4
200	6	200	5
225	6	225	5
250	7	250	5
275	7	275	5
300	7	300	6
325	8	325	6
350	8	350	6
375	8	375	6
400	9	400	6

* For total input falling between listed figures, use next largest listed input.

** These figures are based on a maximum equivalent duct length of 20 ft.
For equivalent duct lengths in excess of 20 ft., up to and including a maximum of 50 ft., increase round duct diameter by one size.

Table 9.32.3.C.

Minimum Air Supply Duct(1) Diameter for a Combination Force Air/Ventilation System		
Max. Total Interior Volume,(2) m^3	Max. Total Floor Area(2) Based on Standard 2.44 m Ceiling Height, m^2	Minimum Air Supply Duct(1) Diameter, mm
536	220	100
805	330	125
1122	460	150

Note 1
'Return Duct Plenum' means anywhere in the Return Air System.
(B.C. Building Code, Page 12 Definitions)

Table 9.32.3.8

Make-up Air Opening Size		
Maximum Ventilation Rate Controlled Automatically or Provided Continuously, L/s	Minimum Make-up Air Duct	
	Vent Area, cm^2	Dia., mm
8	47	80
12	66	90
15	85	100
17	95	110
20	114	120
25	142	130
30	170	150
35	199	160
40	227	170
45	255	180
50	284	190
55	312	200
60	340	210

Table 9.32.3.9

Exhaust Duct Size for a Basic Ventilation System		
Maximum Exhaust Fan Ventilation Rate, L/s	Minimum Exhaust Duct(1) Diameter, mm	
	Smooth Duct	Flexible Duct
10	75	100
25	100	125
45	125	150
70	150	175

Heat Load Worksheet
Square Foot Method

Date _____ Job # _____
Job address _____
_____
Completed by _____

STEP 1: Calculate **Dwelling Heat Load =**

_____sq.ft. (Total heated floor area) X _____ BTUH/sq. ft. (Dwelling Heat Load Factor) = _____BTUH **A**

STEP 2: If home has a heated crawlspace, calculate **Crawlspace Heat Load =**

_____sq.ft. (Total heated area of crawlspace) X _____ BTUH/ sq. ft. (Crawlspace Heat Load Factor) = _____BTUH **B**

STEP 3: **Base Heat Load @ 55°F DTD** (Box A + Box B = Box C) = _____BTUH **C**

STEP 4: Multiply Base Heat Load (Box C) by Regional Temperature Adjustment (RTA) factor from Design Temperature Chart. X _____ **D**

STEP 5: **Regionally Adjusted Base Heat Load** (Box C X Box D = Box E) = _____BTUH **E**

STEP 6: Add thermostat **Setback Pick-up factor of 10%.**

0.10 X _____BTUH in Box E = _____BTUH **F**

STEP 7: If Dwelling heated with hot-water appliance, skip STEP 8; proceed to STEP 9.

STEP 8: Add heat load due to outdoor air brought in for combustion (B149.1 & .2) with 4" Ø duct and directly connected to R.A. Plenum
Add 3000 BTUH times RTA factor (Box D) = 3000 BTUH X _____ = _____ BTUH **G**

STEP 9: Add Box E + F + G =
Total BTUH for Appliance Selection = _____ BTUH **H**

For use with Step 1

DWELLING HEAT LOAD FACTOR
Btuh/sq.ft. @ 55°F DTD

Dwelling Type—Duct location	ACH Rate		
	.5	.75	1
All HEATED areas including basement Ducts in conditioned space	14	16	18
All HEATED areas over heated crawlspace—Ducts in conditioned space	15	17	19
All HEATED areas slab-on-grade construction—Ducts in conditioned space	17	19	21
Ducts or piping in **unconditioned** space or in concrete slab	19	21	23

For use with Step 2

CRAWLSPACE HEAT LOAD FACTOR
Btuh/sq.ft. @ 55°F DTD

Crawlspace Height	ACH Rate		
	.5	.75	1
2'	5	6	7
3'	7	8	9
4'	8	9	10
5'	10	11	12

ACH Rates for standard, new constuction:
Use .5 ACH for dwelling in unexposed site. Use .75 ACH in moderately exposed site. Use 1 ACH in exposed site.

Example 1
Square Foot Method

See page 2-9 for Heat Loss calculation worksheet

Heating Appliance Selection Worksheet
Forced Air Heating Systems

Total Heated Floor Area of Dwelling = 2052 Sq. Ft.

STEP 1: **Dwelling Heat Loss**
(From Box H, Square Foot Worksheet or Short Form Worksheet) = 33,217 BTUH **A**

STEP 2: Use manufacturer's specification tables to select an Appliance with a **BTUH Output** equivalent to Box A or next largest size.

Selected Appliance Heating Capacity:

Input 50,000 BTUH **B**

[X] sea level [ ] high altitude

Output 40,300 BTUH **C**

STEP 3: **Appliance Air Circulation:**

Heating Function only (no options)	@ .3" W.C. External Static Pressure (ESP)	.3	**D**
Evaporator Coil Installed	Add .2" W.C. External Static Pressure (ESP)	Ø	**E**
High Efficiency Air Filter Installed	Add .1" W.C. External Static Pressure (ESP)	Ø	**F**
	Total System ESP (Box D + Box E + Box F) =	.3	**G**

Motor Speed Selected med low @ .3 ESP (Box G) = **Heating** CFM 660 CFM **H**

Cooling Air Capacity @ 400 CFM/Ton

Tons	1.5	2.0	2.5	3.0	4.0	5.0
CFM	600	800	1000	1200	1600	2000

Nominal Tons of cooling capacity = _____ Tons

Motor Speed Selected _____ @ _____ ESP (Box G) = **Cooling** CFM _____ CFM **I**

STEP 4: **RETRO-FIT only : Measured capacity of duct system** = _____ CFM **J**
Attach Retro-fit Worksheet

Box J must be ≥ to Box H

STEP 5: **Duct System designed to:** [X] **Heating Only** or
[ ] **A/C Ready: Future A/C duct sized to** _____ **CFM @** _____ **ESP**

STEP 6: **Temperature Rise** = Furnace output divided by (heating CFM X 1.1).

(Box C) 40,300 BTUH / (Box H) 660 CFM X 1.1 = Temperature Rise = 55.5 °F **K**

Temperature Rise Range
from manufacturer's Technical Specifications: 45-75 °F (Box K must fall within this range)

Sample

MANUFACTURER'S TECHNICAL SPECIFICATIONS

MODEL	A	B	C	D
GAS TYPE	NAT	NAT	NAT	NAT
INPUT (BTUH)	50,000	75,000	100,000	125,000
OUTPUT	**40,300**	**59,700**	**80,000**	**100,700**
RATED EXT. STATIC PRESS.	.10/0.5	.12/0.5	.15/0.5	.20/0.5
TEMPERATURE RISE	45-75	35-65	40-70	45-75
VOLTS/AMP	115/4.6	115/8.2	115/8.2	115/11.0
TRANSFORMER SIZE (VA)	40	40	40	40
ANTICIPATOR SETTING	.85	.85	.85	.85
LIMIT SETTING MAX	250	210	210	160
FAN SW SETTING: ON	125	125	125	125
OFF	100	100	100	100
GAS VALVE MFG/TYPE	MH/VR8204A	MH/VR8204A	MH/VR8204A	MH/VR8204A
REGULATION TYPE	SNAP	SNAP	SNAP	SNAP
MANIFOLD PRESSURE	3.5	3.5	3.5	3.5
ORIFICE SIZE	2/#42	3/#42	4/#42	5/#42
IGNITION TYPE	MH/S86F	MH/S86F	MH/S86F	MH/S86F
PILOT ORIFICE SIZE	.018	.018	.018	.018
SPARK GAP	1/8	1/8	1/8	1/8
PRESSURE SWITCH	0.65	0.70	0.44	0.70

NOTE— For elevations above 2,000 Feet: the ratings should be reduced by 4% for each 1000 feet above sea level. The furnace must not be derated; orifice changes should only be made if necessary for altitude.

Blower Performance Data

MODEL			A		B		C		D	
Blower Data Type & Size			DD 9-6A		DD 10-7A		DD 10-8A		DD 10-9A	
Motor Horse Power			1/6 PSC		1/2 PSC		1/2 PSC		3/4 PSC	
Air Delivery (CFM) at Various External Static Pressures (in. W.C.)	ESP	Speeds	L/S	CFM	L/S	CFM	L/S	CFM	L/S	CFM
	0.10	Low	–	–	410	870	420	890	490	1035
		Med. Low	300	640	545	1155	535	1130	650	1380
		Med. High	330	700	695	1470	675	1425	810	1720
		High	460	975	835	1765	830	1755	985	2090
	0.20	Low	–	–	420	890	430	910	495	1050
		Med. Low	310	655	545	1155	540	1140	645	1365
		Med. High	355	755	685	1450	670	1420	795	1685
		High	445	960	805	1705	815	1725	950	2015
	0.30	Low	–	–	430	910	435	920	500	1055
		Med. Low	310	660	545	1150	540	1140	635	1345
		Med. High	355	755	675	1425	665	1405	775	1645
		High	445	945	780	1650	795	1680	915	1935
	0.40	Low	–	–	435	920	440	930	500	1060
		Med. Low	310	660	540	1140	535	1135	630	1330
		Med. High	355	750	660	1395	655	1385	755	1595
		High	440	930	755	1600	765	1620	875	1850
	0.50	Low	–	–	440	930	440	930	495	1050
		Med. Low	305	650	530	1120	530	1120	615	1300
		Med. High	350	740	635	1350	635	1350	725	1540
		High	420	895	715	1520	735	1560	835	1770
	0.60	Low	–	–	435	920	435	925	485	1030
		Med. Low	300	635	520	1100	520	1105	590	1250
		Med. High	340	725	615	1300	625	1325	695	1475
		High	400	850	690	1465	705	1495	795	1680

Worksheet 1

Supply Air System Layout & Summary

JOB #:_____ Address_____

Date_____Completed by _____

Total Supply Air required = [ ] A Max. Supply Air delivered = [ ] B

Trunk Duct Adjustment:

Box A / Box B = _____ = [ ] C

Multiply sub-totals for trunk sizing by Box C to adjust trunk duct sizes for actual cfm carried.

SKETCH

Show all trunks and branches.

floor level

Branch Duct Size	4"Ø			5"Ø			6"Ø		
Number of fittings per branch	3 ftg	5 ftg	7 ftg	3 ftg	5ftg	7ftg	3ftg	5ftg	7ftg
Max. CFM per branch	35	30	25	65	55	45	100	90	75
Sub-totals for Trunk Sizing									
	a	b	c	d	e	f	g	h	i

a+b+c+d+ e+f+g+h+i = [ ] CFM B Box B≥ Box A

= Box B

Trunk Duct Sizes

#1:	#4:
#2:	#5:
#3:	#6:

Worksheet 2
Return Air System Layout & Summary

JOB #:_____ Address_____

_____

Date_____Completed by _____

Show all trunks and branches.	Wall construction	2 x 4	2 x 6	2 x 4	2 x 6	2 x 4	2 x 6
SKETCH	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	200	260	350	460	425	580
Supply Register Summary per RG	Sub-totals for Trunk Sizing						
	= Box B	a	b	c	d	e	f

a+b+c+ d+e+f = _____ CFM B Box B≥ Box A

Trunk Duct Sizes	
#1:	#3:
#2:	#4:
Return Air Drop Size:	

Example 1
Square Foot Method

See page 2-9 for Heat Loss calculation worksheet

Heating Appliance Selection Worksheet
Forced Air Heating Systems

Total Heated Floor Area of Dwelling = 2052 Sq. Ft.

STEP 1: **Dwelling Heat Loss**
(From Box H, Square Foot Worksheet or Short Form Worksheet) = 33,217 BTUH **A**

STEP 2: Use manufacturer's specification tables to select an Appliance with a **BTUH Output** equivalent to Box A or next largest size.

Selected Appliance Heating Capacity:

Input 50,000 BTUH **B**

[X] sea level [ ] high altitude

Output 40,300 BTUH **C**

STEP 3: **Appliance Air Circulation:**

Heating Function only (no options)	@ .3" W.C. External Static Pressure (ESP)	.3	**D**
Evaporator Coil Installed	Add .2" W.C. External Static Pressure (ESP)	Ø	**E**
High Efficiency Air Filter Installed	Add .1" W.C. External Static Pressure (ESP)	Ø	**F**
	Total System ESP (Box D + Box E + Box F) =	.3	**G**

Motor Speed Selected med low @ .3 ESP (Box G) = **Heating** CFM 660 CFM **H**

Cooling Air Capacity @ 400 CFM/Ton

Tons	1.5	2.0	2.5	3.0	4.0	5.0
CFM	600	800	1000	1200	1600	2000

Nominal Tons of cooling capacity = _____ Tons

Motor Speed Selected _____ @ _____ ESP (Box G) = **Cooling** CFM _____ CFM **I**

STEP 4: **RETRO-FIT only : Measured capacity of duct system** = _____ CFM **J**
Attach Retro-fit Worksheet

Box J must be ≥ to Box H

STEP 5: **Duct System designed to:** [X] **Heating Only** or
[ ] **A/C Ready: Future A/C duct sized to** _____ **CFM @** _____ **ESP**

STEP 6: **Temperature Rise** = Furnace output divided by (heating CFM X 1.1).

(Box C) 40,300 BTUH / (Box H) 660 CFM X 1.1 = Temperature Rise = 55.5 °F **K**

Temperature Rise Range
from manufacturer's Technical Specifications: 45-75 °F (Box K must fall within this range)

Example 1
Square Foot Method

See page 2-9 for Heat Loss calculation worksheet

Heating Appliance Selection Worksheet
Forced Air Heating Systems

Total Heated Floor Area of Dwelling = 2052 Sq. Ft.

STEP 1: **Dwelling Heat Loss**
(From Box H, Square Foot Worksheet or Short Form Worksheet) = 33,217 BTUH **A**

STEP 2: Use manufacturer's specification tables to select an Appliance with a **BTUH Output** equivalent to Box A or next largest size.

Selected Appliance Heating Capacity: **Input** 50,000 BTUH **B**

[X] sea level [ ] high altitude **Output** 40,300 BTUH **C**

STEP 3: **Appliance Air Circulation:**

Heating Function only (no options) @ .3" W.C. External Static Pressure (ESP) .3 **D**

Evaporator Coil Installed Add .2" W.C. External Static Pressure (ESP) Ø **E**

High Efficiency Air Filter Installed Add .1" W.C. External Static Pressure (ESP) Ø **F**

Total System ESP (Box D + Box E + Box F) = .3 **G**

Motor Speed Selected med low @ .3 ESP (Box G) = **Heating** CFM 660 CFM **H**

Cooling Air Capacity @ 400 CFM/Ton

Tons	1.5	2.0	2.5	3.0	4.0	5.0
CFM	600	800	1000	1200	1600	2000

Nominal Tons of cooling capacity = _____ Tons

Motor Speed Selected _____ @ _____ ESP (Box G) = **Cooling** CFM _____ CFM **I**

STEP 4: **RETRO-FIT only : Measured capacity of duct system** = _____ CFM **J**
Attach Retro-fit Worksheet

Box J must be ≥ to Box H

STEP 5: **Duct System designed to:** [X] **Heating Only** or
[ ] **A/C Ready: Future A/C duct sized to** _____ **CFM @** _____ **ESP**

STEP 6: **Temperature Rise** = Furnace output divided by (heating CFM X 1.1).

(Box C) 40,300 BTUH / (Box H) 660 CFM X 1.1 = Temperature Rise = 55.5 °F **K**

Temperature Rise Range
from manufacturer's Technical Specifications: 45-75 °F (Box K must fall within this range)

Heat Load Worksheet
Square Foot Method

Date _____ Job # _____
Job address _____
_____
Completed by _____

STEP 1: Calculate **Dwelling Heat Load =**

_____sq.ft. (Total heated floor area) X _____ BTUH/sq. ft. (Dwelling Heat Load Factor) = _____BTUH **A**

STEP 2: If home has a heated crawlspace, calculate **Crawlspace Heat Load =**

_____sq.ft. (Total heated area of crawlspace) X _____ BTUH/ sq. ft. (Crawlspace Heat Load Factor) = _____BTUH **B**

STEP 3: **Base Heat Load @ 55°F DTD** (Box A + Box B = Box C) = _____BTUH **C**

STEP 4: Multiply Base Heat Load (Box C) by Regional Temperature Adjustment (RTA) factor from Design Temperature Chart. X _____ **D**

STEP 5: **Regionally Adjusted Base Heat Load** (Box C X Box D = Box E) = _____BTUH **E**

STEP 6: Add thermostat **Setback Pick-up factor of 10%.**

0.10 X _____BTUH in Box E = _____BTUH **F**

STEP 7: If Dwelling heated with hot-water appliance, skip STEP 8; proceed to STEP 9.

STEP 8: Add heat load due to outdoor air brought in for combustion (B149.1 & .2) with 4" Ø duct and directly connected to R.A. Plenum
Add 3000 BTUH times RTA factor (Box D) = 3000 BTUH X _____ = _____ BTUH **G**

STEP 9: Add Box E + F + G =
Total BTUH for Appliance Selection = BTUH **H**

For use with Step 1

DWELLING HEAT LOAD FACTOR
Btuh/sq.ft. @ 55°F DTD

Dwelling Type—Duct location	ACH Rate		
	.5	.75	1
All HEATED areas including basement Ducts in conditioned space	14	16	18
All HEATED areas over heated crawl-space—Ducts in conditioned space	15	17	19
All HEATED areas slab-on-grade con-struction—Ducts in conditioned space	17	19	21
Ducts or piping in **unconditioned** space or in concrete slab	19	21	23

For use with Step 2

CRAWLSPACE HEAT LOAD FACTOR
Btuh/sq.ft. @ 55°F DTD

Crawlspace Height	ACH Rate		
	.5	.75	1
2'	5	6	7
3'	7	8	9
4'	8	9	10
5'	10	11	12

ACH Rates for standard, new constuction:
Use .5 ACH for dwelling in unexposed site. Use .75 ACH in moderately exposed site. Use 1 ACH in exposed site.

Sample

MANUFACTURER'S TECHNICAL SPECIFICATIONS

MODEL	A	B	C	D
GAS TYPE	NAT	NAT	NAT	NAT
INPUT (BTUH)	50,000	75,000	100,000	125,000
OUTPUT	**40,300**	**59,700**	**80,000**	**100,700**
RATED EXT. STATIC PRESS.	.10/0.5	.12/0.5	.15/0.5	.20/0.5
TEMPERATURE RISE	45-75	35-65	40-70	45-75
VOLTS/AMP	115/4.6	115/8.2	115/8.2	115/11.0
TRANSFORMER SIZE (VA)	40	40	40	40
ANTICIPATOR SETTING	.85	.85	.85	.85
LIMIT SETTING MAX	250	210	210	160
FAN SW SETTING: ON	125	125	125	125
OFF	100	100	100	100
GAS VALVE MFG/TYPE	MH/VR8204A	MH/VR8204A	MH/VR8204A	MH/VR8204A
REGULATION TYPE	SNAP	SNAP	SNAP	SNAP
MANIFOLD PRESSURE	3.5	3.5	3.5	3.5
ORIFICE SIZE	2/#42	3/#42	4/#42	5/#42
IGNITION TYPE	MH/S86F	MH/S86F	MH/S86F	MH/S86F
PILOT ORIFICE SIZE	.018	.018	.018	.018
SPARK GAP	1/8	1/8	1/8	1/8
PRESSURE SWITCH	0.65	0.70	0.44	0.70

NOTE— For elevations above 2,000 Feet: the ratings should be reduced by 4% for each 1000 feet above sea level. The furnace must not be derated; orifice changes should only be made if necessary for altitude.

Blower Performance Data

MODEL			A		B		C		D	
Blower Data Type & Size			DD 9-6A		DD 10-7A		DD 10-8A		DD 10-9A	
Motor Horse Power			1/6 PSC		1/2 PSC		1/2 PSC		3/4 PSC	
Air Delivery (CFM) at Various External Static Pressures (in. W.C.)	ESP	Speeds	L/S	CFM	L/S	CFM	L/S	CFM	L/S	CFM
	0.10	Low	–	–	410	870	420	890	490	1035
		Med. Low	300	640	545	1155	535	1130	650	1380
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		High	460	975	835	1765	830	1755	985	2090
	0.20	Low	–	–	420	890	430	910	495	1050
		Med. Low	310	655	545	1155	540	1140	645	1365
		Med. High	355	755	685	1450	670	1420	795	1685
		High	445	960	805	1705	815	1725	950	2015
	0.30	Low	–	–	430	910	435	920	500	1055
		Med. Low	310	660	545	1150	540	1140	635	1345
		Med. High	355	755	675	1425	665	1405	775	1645
		High	445	945	780	1650	795	1680	915	1935
	0.40	Low	–	–	435	920	440	930	500	1060
		Med. Low	310	660	540	1140	535	1135	630	1330
		Med. High	355	750	660	1395	655	1385	755	1595
		High	440	930	755	1600	765	1620	875	1850
	0.50	Low	–	–	440	930	440	930	495	1050
		Med. Low	305	650	530	1120	530	1120	615	1300
		Med. High	350	740	635	1350	635	1350	725	1540
		High	420	895	715	1520	735	1560	835	1770
	0.60	Low	–	–	435	920	435	925	485	1030
		Med. Low	300	635	520	1100	520	1105	590	1250
		Med. High	340	725	615	1300	625	1325	695	1475
		High	400	850	690	1465	705	1495	795	1680

Worksheet 1

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Date_____Completed by _____

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Trunk Duct Adjustment:

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floor level

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Max. CFM per branch	35	30	25	65	55	45	100	90	75
Sub-totals for Trunk Sizing									
	a	b	c	d	e	f	g	h	i

a+b+c+d+ e+f+g+h+i = [ ] CFM B Box B≥ Box A

= Box B

Trunk Duct Sizes

#1:	#4:
#2:	#5:
#3:	#6:

Worksheet 2
Return Air System Layout & Summary

JOB #:_____ Address_____

_____

Date_____Completed by _____

Show all trunks and branches.	Wall construction	2 x 4	2 x 6	2 x 4	2 x 6	2 x 4	2 x 6
SKETCH	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	200	260	350	460	425	580
Supply Register Summary per RG	Sub-totals for Trunk Sizing						
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a+b+c+ d+e+f = _____ CFM B Box B≥ Box A

Trunk Duct Sizes	
#1:	#3:
#2:	#4:
Return Air Drop Size:	