# HVAC RESIDENTIAL WORKSHEET

Stories:

- One Story _____
- Two Story _____
- Split Entry _____

Number of Bedrooms: _____

Basement:

- Full _____
- Crawl Space _____
- Slab on Grade _____

Total Sq.Ft. of Conditional Space including basement _____ Ft.$^2$

Average Ceiling Height: _____ Ft.

Mechanical Room Area: length x height x width = _____ Ft.$^3$

Gas Water Heater:

- Direct Vent _____ _____ BTU Input
- Power Vent _____ _____ BTU Input
- Atmospheric _____ _____ BTU Input

Gas Furnace:

- Direct Vent _____ _____ BTU Input
- Power Vent _____ _____ BTU Input
- Atmospheric _____ _____ BTU Input

Fireplace:

- Gas _____
- Solid Fuel _____
- None _____

1 Bath Fan @ _____cfm

2 Bath Fans @ _____ cfm

Kitchen Hood @ _____ cfm

Clothes Dryer @ default 135 cfm unless larger _____ cfm

City of Austin
500 Fourth Avenue N.E.
Austin, Minnesota 55912-3773

Building Department
507-437-9950 Fax 507-437-7101

| | | | |
|---|---|---|---|
| Site Address | | Date: | |
| Contractor | | Complete By: | |

**SECTION A**

| Ventilation Quantity (Determine quantity by using Table N1104.2 or equation 11-1) | | | |
|---|---|---|---|
| Square feet(Conditioned area including Basement –finished or unfinished) | | Total required ventilation | |
| Number of Bedrooms | | Continuous ventilation | |

**SECTION B**

| Ventilation Method (Choose either balanced or exhaust only) | | | | | |
|---|---|---|---|---|---|
| ☐ Balanced, HRV (Heat Recovery Ventilator) or ERV (Energy) Recovery Ventilator) – cfm of unit in low must not Exceed continuous ventilation rating by more than 100% | | | | ☐ Exhaust Only Continuous fan rating cfm | |
| Low cfm: | | High cfm: | | Continuous fan rating in cfm (capacity must not exceed continuous ventilation rating by more than 100% | |

**SECTION C**

| Ventilation Fan Schedule | | | |
|---|---|---|---|
| Description | Location | Continuous | Total Ventilation |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**SECTION D**

| Controls (Describe operation and control of the continuous ventilation) |
|---|
| |
| |
| |
| |

**SECTION E**

| Make-up Air for Ventilation | | | |
|---|---|---|---|
| | Passive (determined from calculations from Table 501.4.1) | | |
| | Powered (determined from calculations from Table 501.4.1) | | |
| | Interlocked with exhaust device (determined from calculation from Table 501.4.1) | | |
| | Other, describe: | | |
| Location of duct or system ventilation make-up air: Determined from make-up air opening table | | | |
| Cfm | | Size & type (round, rectangular, flex or rigid) | |

**SECTION F**

| Make-up Air for Combustion | | | |
|---|---|---|---|
| | Not required per mechanical code (No atmospheric or power vented appliances) | | |
| | Passive (see IFGC Appendix E, Worksheet E-1) | Size & Type: | |
| | Other, describe: | | |

**N1104.2 Total ventilation rate.** The mechanical ventilation system shall provide sufficient outdoor air to equal the total ventilation rate average, for each one-hour period according to Table N1104.2, or Equation 11-1, based on the number of bedrooms and the square footage of conditioned space, including the basement but excluding conditioned crawl spaces. For heat recovery ventilators and energy recovery ventilators the average hourly ventilation capacity must be determined in consideration of any reduction of exhaust or outdoor air intake, or both, for defrost or other equipment cycling per HVI Standard 920.

Equation 11-1:
Total ventilation rate (cfm) = (0.02 x square feet of conditioned space) + [15 x (number of bedrooms + 1)]

**N1104.2.1 Continuous ventilation.** A minimum of 50 percent of the total ventilation rate, but not less than 40 cfm, shall be provided, on a continuous rate average for each one-hour period according to Table N1104.2 or Equation 11-2. The portion of the mechanical ventilation system that is intended to be continuous may have automatic cycling controls providing the average flow rate for each hour meeting the requirements of Section N1104.2.1.

Equation 11-2:
Continuous ventilation (cfm) = total ventilation rate/2

**N1104.2.1.1 Ventilation rate.** The continuous ventilation system shall be balanced in accordance with Section N1104.4.2.
**Exception:** If the local ventilation requirements according to IRC Section R303.3 are being met by the continuous ventilation system, it shall be capable of operating at a rate not more than 100 percent greater than required by Section N1104.2.1.

**N1104.2.2 Intermittent ventilation.** The difference between the total ventilation rate and the continuous ventilation rate shall be based on flow rates as designed or as installed.

**Table N1104.2**
Total and Continuous Ventilation Rates (in cfm)

| | Number of Bedrooms | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Conditioned space (in sq. ft.) | Total/ continuous | Total/ continuous | Total/ continuous | Total/ continuous | Total/ continuous | Total/ continuous |
| 1000-1500 | 60/40 | 75/40 | 90/45 | 105/53 | 120/60 | 135/68 |
| 1501-2000 | 70/40 | 85/43 | 100/50 | 115/58 | 130/65 | 145/73 |
| 2001-2500 | 80/40 | 95/48 | 110/55 | 125/63 | 140/70 | 155/78 |
| 2501-3000 | 90/45 | 105/53 | 120/60 | 135/68 | 150/75 | 165/83 |
| 3001-3500 | 100/50 | 115/58 | 130/65 | 145/73 | 160/80 | 175/88 |
| 3501-4000 | 110/55 | 125/63 | 140/70 | 155/78 | 170/85 | 185/93 |
| 4001-4500 | 120/60 | 135/68 | 150/75 | 165/83 | 180/90 | 195/98 |
| 4501-5000 | 130/65 | 145/73 | 160/80 | 175/88 | 190/95 | 205/103 |
| 5001-5500 | 140/70 | 155/78 | 170/85 | 185/93 | 200/100 | 215/108 |
| 5501-6000 | 150/75 | 165/83 | 180/90 | 195/98 | 210/105 | 225/113 |

[1] Conditioned space includes basement.

[2] If conditioned space exceeds 6000 sq.ft. or there are more than 6 bedrooms, use Equation 11-1 from Section N1104.2 to calculate total ventilation rate.

**Table 501.4.1**
**Procedure to Determine Makeup Air Quantity for Exhaust Equipment in ~~Dwellings~~Dwelling Units**
Use the Appropriate Column to Estimate House Infiltration

| | One or multiple power vent or direct vent appliances or no combustion appliances[A] | One or multiple fan-assisted appliances and power vent or direct vent appliances[B] | One atmospherically vented gas or oil appliance or one solid fuel appliance[C] | Multiple appliances that are atmospherically vented gas or oil appliances or solid fuel appliances[D] |
|---|---|---|---|---|
| 1a) pressure factor (cfm/sf) | 0.15 | 0.09 | 0.06 | 0.03 |
| b) conditioned floor area (sf) (including unfinished basements) | | | | |
| Estimated House Infiltration (cfm): [1a x 1b] | | | | |
| | | | | |
| a) clothes dryer | 135 | 135 | 135 | 135 |
| b) 80% of largest exhaust rating (cfm): (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust) | | | | |
| c) 80% of next largest exhaust rating (cfm): (not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust) | not applicable | | | |
| Total Exhaust Capacity (cfm): [2a+2b+2c] | | | | |
| 3. Makeup Air Requirement<br>a) Total Exhaust Capacity (from above) | | | | |
| b) Estimated House Infiltration (from above) | | | | |
| Makeup Air Quantity (cfm): [3a – 3b] (if value is negative, no makeup air is needed) | | | | |
| 4. For Makeup Air Opening Sizing, refer to Table 501.3.2 | | | | |

A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliances.

| Table 501.4.2<br>Makeup Air Opening Sizing Table for New and Existing ~~Dwellings~~Dwelling Units | | | | | |
|---|---|---|---|---|---|
| | One or multiple power vent or direct vent appliances or no combustion appliances[A] | One or multiple fan-assisted appliances and power vent or direct vent appliances[B] | One atmospherically vented gas or oil appliance or one solid fuel appliance[C] | Multiple appliances that areatmospherically vented gas or oil appliances or solid fuel appliances[D] | Passive makeup air opening duct diameter[E,F,G] |
| Type of opening or system | (cfm) | (cfm) | (cfm) | (cfm) | (inches) |
| Passive Opening | 1-36 | 1-22 | 1-15 | 1-9 | 3 |
| Passive Opening | 37-66 | 23-41 | 16-28 | 10-17 | 4 |
| Passive Opening | 67-109 | 42-66 | 29-46 | 18-28 | 5 |
| Passive Opening | 110-163 | 67-100 | 47-69 | 29-42 | 6 |
| Passive Opening | 164-232 | 101-143 | 70-99 | 43-61 | 7 |
| Passive Opening | 233-317 | 144-195 | 100-135 | 62-83 | 8 |
| Passive Opening with Motorized Damper | 318-419 | 196-258 | 136-179 | 84-110 | 9 |
| Passive Opening with Motorized Damper | 420-539 | 259-332 | 180-230 | 111-142 | 10 |
| Passive Opening with Motorized Damper | 540-679 | 333-419 | 231-290 | 143-179 | 11 |
| Powered Makeup Air[H] | >679 | >419 | >290 | >179 | not applicable |

A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliance(s).

E An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

F If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

G Barometric dampers are prohibited in passive makeup air openings when any atmospherically vented appliance is installed.

H Powered makeup air shall be electrically interlocked with the largest exhaust system.

## 1346.6012 IFGC APPENDIX E, WORKSHEET E-1.

**IFGC Appendix E, Worksheet E-1**

Residential Combustion Air Calculation Method
(for Furnace, Boiler, and/or Water Heater in the Same Space)

**Step 1:** Complete vented combution appliace information:

Furnace/Boiler:
____ Draft Hood ____ Fan Assisted ____ Direct Vent Input: _____Btu/hr
(Not fan Assisted) & Power Vent

Water Heater:
____ Draft Hood ____ Fan Assisted ____ Direct Vent Input: _____Btu/hr
( Not fan Assisted) & Power Vent

**Step 2:** Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings. CAS volume: _____ $ft^3$

**Step 3:** Determine air Changes per Hour (ACH)[1]

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

**Step 4:** Determine Required Volume for Combustion Air.

**4a.** Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES) Input: _____Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV) TRV: _____ $ft^3$

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

**4b.** Known Air Infiltration Rate (KAIR) Method

Total Btu/hr input of all fan-assisted and power vent appliances
(DO NOT COUNT DIRECT VENT APPLIANCES) Input: _____Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find
Required Volume Fan Assisted (RVFA) RVFA: _____ $ft^3$

Total Btu/hr input of all non-fan-assisted appliances Input: _____Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find
Required Volume Non-Fan-Assisted (RVNFA) RVNFA: _____ $ft^3$

Total Required Volume (TRV) = RVFA + RVNFA TRV = _____ + _____ = _____ $ft^3$

If CAS Volume (from Step 2) ***is greater than*** TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) ***is less than*** TRV then go to **STEP 5.**

**Step 5:** Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2) ***divided by*** TRV (from Step 4a or Step 4b) Ratio = __ / __ = __

**Step 6:** Calculate Reduction Factor (RF).

RF = 1 ***minus*** Ratio RF = 1 - _____ = _____

**Step 7:** Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion Appliances in the same CAS (EXCEPT DIRECT VENT) Input: _____Btu/hr

Combustion Air Opening Area (CAOA):
Total Btu/hr ***divided*** by 3000 Btu/hr per $in^2$ CAOA = _____ /3000 Btu/hr per $in^2$ = _____ $in^2$

**Step 8:** Calculate Minimum CAOA.

Minimum CAOA = CAOA ***multiplied by*** RF Minimum CAOA = _____ x _____ = _____ $in^2$

**Step 9:** Calculate Combustion Air Opening Diameter (CAOD)

CAOD = 1.13 ***multiplied by the square root of*** Minimum CAOA CAOD = 1.13 x $\sqrt{\text{Minimum CAOA}}$ = _____ in

[1]If desired, ACH can be determined using ASHRAE calculation or blower door test. Follow procedures in Section 304.

## 1346.6014 IFGC APPENDIX E, TABLE E-1.

| IFGC Appendix E, Table E-1<br>Residential Combustion Air Required Volume (Required Interior Volume Based on Input Rating of Appliances) | | | | | |
|---|---|---|---|---|---|
| Input Rating (Btu/hr) | Standard Method ($ft^3$) | Known Air Infiltration Rate (KAIR) Method ($ft^3$) Fan Assisted | | Non-Fan-Assisted | |
| | | 1994[1] to Present | Pre 1994[2] | 1994[1] to Present | Pre 1994[2] |
| 5,000 | 250 | 375 | 188 | 525 | 263 |
| 10,000 | 500 | 750 | 375 | 1,050 | 525 |
| 15,000 | 750 | 1,125 | 563 | 1,575 | 788 |
| 20,000 | 1,000 | 1,500 | 750 | 2,100 | 1,050 |
| 25,000 | 1,250 | 1,875 | 938 | 2,625 | 1,313 |
| 30,000 | 1,500 | 2,250 | 1,125 | 3,150 | 1,575 |
| 35,000 | 1,750 | 2,625 | 1,313 | 3,675 | 1,838 |
| 40,000 | 2,000 | 3,000 | 1,500 | 4,200 | 2,100 |
| 45,000 | 2,250 | 3,375 | 1,688 | 4,725 | 2,363 |
| 50,000 | 2,500 | 3,750 | 1,875 | 5,250 | 2,625 |
| 55,000 | 2,750 | 4,125 | 2,063 | 5,775 | 2,888 |
| 60,000 | 3,000 | 4,500 | 2,250 | 6,300 | 3,150 |
| 65,000 | 3,250 | 4,875 | 2,438 | 6,825 | 3,413 |
| 70,000 | 3,500 | 5,250 | 2,625 | 7,350 | 3,675 |
| 75,000 | 3,750 | 5,625 | 2,813 | 7,875 | 3,938 |
| 80,000 | 4,000 | 6,000 | 3,000 | 8,400 | 4,200 |
| 85,000 | 4,250 | 6,375 | 3,188 | 8,925 | 4,463 |
| 90,000 | 4,500 | 6,750 | 3,375 | 9,450 | 4,725 |
| 95,000 | 4,750 | 7,125 | 3,563 | 9,975 | 4,988 |
| 100,000 | 5,000 | 7,500 | 3,750 | 10,500 | 5,250 |
| 105,000 | 5,250 | 7,875 | 3,938 | 11,025 | 5,513 |
| 110,000 | 5,500 | 8,250 | 4,125 | 11,550 | 5,775 |
| 115,000 | 5,750 | 8,625 | 4,313 | 12,075 | 6,038 |
| 120,000 | 6,000 | 9,000 | 4,500 | 12,600 | 6,300 |
| 125,000 | 6,250 | 9,375 | 4,688 | 13,125 | 6,563 |
| 130,000 | 6,500 | 9,750 | 4,875 | 13,650 | 6,825 |
| 135,000 | 6,750 | 10,125 | 5,063 | 14,175 | 7,088 |
| 140,000 | 7,000 | 10,500 | 5,250 | 14,700 | 7,350 |
| 145,000 | 7,250 | 10,875 | 5,438 | 15,225 | 7,613 |
| 150,000 | 7,500 | 11,250 | 5,625 | 15,750 | 7,875 |
| 155,000 | 7,750 | 11,625 | 5,813 | 16,275 | 8,138 |
| 160,000 | 8,000 | 12,000 | 6,000 | 16,800 | 8,400 |
| 165,000 | 8,250 | 12,375 | 6,188 | 17,325 | 8,663 |
| 170,000 | 8,500 | 12,750 | 6,375 | 17,850 | 8,925 |
| 175,000 | 8,750 | 13,125 | 6,563 | 18,375 | 9,188 |
| 180,000 | 9,000 | 13,500 | 6,750 | 18,900 | 9,450 |
| 185,000 | 9,250 | 13,875 | 6,938 | 19,425 | 9,713 |
| 190,000 | 9,500 | 14,250 | 7,125 | 19,950 | 9,975 |
| 195,000 | 9,750 | 14,625 | 7,313 | 20,475 | 10,238 |
| 200,000 | 10,000 | 15,000 | 7,500 | 21,000 | 10,500 |
| 205,000 | 10,250 | 15,375 | 7,688 | 21,525 | 10,763 |
| 210,000 | 10,500 | 15,750 | 7,875 | 22,050 | 11,025 |
| 215,000 | 10,750 | 16,125 | 8,063 | 22,575 | 11,288 |
| 220,000 | 11,000 | 16,500 | 8,250 | 23,100 | 11,550 |
| 225,000 | 11,250 | 16,857 | 8,438 | 23,625 | 11,813 |
| 230,000 | 11,500 | 17,250 | 8,625 | 24,150 | 12,075 |

[1]The 1994 date refers to dwellings constructed under the 1994 Minnesota Energy Code. The default KAIR used in this section of the table is 0.20 ACH.
[2]This section of the table is to be used for dwellings constructed prior to 1994. The default KAIR used in this section of the table is 0.40 ACH.

| N1101.8 Certificate<br>Builders Name/ Company | Date: _____ Site Address: _____<br>Contractor Name: _____ License Number: _____ |
|---|---|

| Location | Type of Insulation | Installed R-Value |
|---|---|---|
| | | |
| Roof/Ceiling | | |
| | | |
| Walls | | |
| | | |
| Slab-on-Grade | | |
| | | |
| Floor | | |
| | | |
| Rim Joist | | |
| | | Interior, Exterior or Integral |
| Foundation Wall | | |
| | | Interior, Exterior or Integral |

| | Type | Location | Size |
|---|---|---|---|
| Makeup Air | | | |
| | | | |
| Combustion Air | | | |
| | | | |
| Water Heating | | | |
| | | | |
| | Manufacturer | Model | |
| | | | |
| Ducts Outside of Conditioned Spaces | | | |
| | | | |
| | Location | R-Value | |
| | | | |
| | | | |

| | Average U-Factor | SHGC (solar heat gain coefficient) |
|---|---|---|
| Fenestration | | |
| | | |

| | Passive | Active |
|---|---|---|
| Radon Control | ☐ | ☐ |
| | | |

| | Type | Input Rating | AFUE | Manufacturer | Model | Calculated Heat Loss |
|---|---|---|---|---|---|---|
| Heating System | | | | | | |
| | | | | | | |
| | | | | | | |

| | Type | Output Rating | SEER | Manufacturer | Model | Cooling Load/Heat Gain |
|---|---|---|---|---|---|---|
| Cooling System | | | | | | |
| | | | | | | |
| | | | | | | |

| | Type | Location | Continuous Ventilation | Total Ventilation |
|---|---|---|---|---|
| Mechanical Ventilation | | | | |
| | | | | |