

**SECTION D
WORKSHEET CA-1**

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

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

| | |
|---|---------------------|
| _____ Draft Hood _____ Fan Assisted _____ Direct Vent | Input: _____ Btu/hr |
| (Not fan assisted) _____ & Power Vent _____ | |
| _____ 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 _____ | |
| _____ 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: _____ ft³

Step 3: Determine Air Changes per Hour (ACH)¹

Default ACH values have been incorporated into Table CA-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 CA-1 to find Total Required Volume (TRV) TRV: _____ ft³

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 CA-1 to find Required Volume Fan Assisted (RVFA) RVFA: _____ ft³

Total Btu/hr of all Non-Fan-Assisted Appliances Input: _____ Btu/hr

Use Non-Fan-Assisted Appliances column in Table CA-1 to find Required Volume Non-Fan-Assisted (RVNFA) RVNFA: _____ ft³

Total Required Volume (TRV) = RVFA + RVNFA TRV = _____ + _____ = _____ ft³

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 in² CAO A = _____ / 3000 Btu/hr per in² = _____ in²

Step 8: Calculate Minimum CAO A.

Minimum CAO A = CAO A **multiplied by** RF Minimum CAO A = _____ x _____ = _____ in²

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

CAOD = 1.13 **multiplied by the square root of** Minimum CAO A CAOD = 1.13 Minimum CAO A = _____ in

¹If desired, ACH can be determined using ASHRAE calculation or blower door test. Follow procedures in Section G304.

SECTION D, TABLE CA-1

Residential Combustion Air (Required Interior Volume Based on Input Rating of Appliance)

| Input Rating (Btu/hr) | Standard Method | Known Air Infiltration Rate Method (KAIR) in cu ft. ^(1,2) | | | |
|--------------------------|-----------------|--|------------|------------------|------------|
| | | Fan Assisted | | Non-Fan Assisted | |
| | | 1994 to Present | Pre - 1994 | 1994 to Present | Pre - 1994 |
| 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 | 16,875 | 8,438 | 23,625 | 11,813 |
| 230,000 | 11,500 | 17,250 | 8,625 | 24,150 | 12,075 |

1. The 1994 date refers to a dwelling constructed under the 1994 Minnesota Energy Code. The default KAIR used in this section of the table is 0.20 air changes per hour (ACH)

2. This section of the table is to be used for dwelling construction prior to 1994. The default KAIR used in this section of the table is 0.40 ACH.