



Municipality of Anchorage



Handout M.03

Combustion Air

General:

The following handout applies to natural and fan assist combustion appliances. It does not apply to closed combustion, direct vent appliances.

For natural gas and propane fired appliances, reference the International Fuel Gas Code (IFGC) as amended by the MOA.

For liquid and solid fuel appliances, reference the International Mechanical Code (IMC) as amended by the MOA.

The purpose of the handout is to clarify the basic combustion air requirements for residential and small commercial systems. This handout illustrates the use of a single opening system only. Since this system minimizes the possibility of freezing piping, it is usually the preferred system. A two opening system as defined in the IMC and IFGC may also be used. All commercial combustion air systems (excluding triplexes and fourplexes) must be designed by an Alaska licensed mechanical engineer in accordance with state statutes.

Minimum required size of combustion air openings:

Case I - Appliances located within a dwelling unit:

All combustion air shall be obtained from the exterior of the building. The opening shall be sized as follows:

1. Calculate the total Btu/hour input rating of all fuel fired appliances located within the room or enclosure.
2. See the opening size table below for the minimum required size, or go to step 3.
3. Calculate the minimum required size of the outdoor opening by dividing the total Btu/hour input by 3000. The resulting size is in square inches. This minimum area is a free area (see below).

The opening size may be reduced in accordance with the IFGC pending the results of an air tightness blower door test performed by an AHFC certified Home Energy Rater.

Case II - Appliances located in a garage:

When fuel fired appliances are located within a garage, the size of the combustion air opening may be reduced substantially by using the following sizing procedure. This sizing method is very similar to a procedure that had been used within the Municipality of Anchorage for the past several years with no reported problems. This existing practice has been modified slightly to bring it into compliance with the IFGC. The procedure is as follows:

1. Calculate the interior volume of the garage. For a simple box this is the length x width x height, all in feet.
2. Calculate the maximum allowed Btu/hour by multiplying the garage volume (step 1) by 1000 Btu/hour and dividing by 50 cubic feet.
3. Calculate the total Btu/hour input rating by adding the inputs of all fuel fired appliances located within the garage.
4. To determine whether additional outside combustion air is required, subtract the maximum allowed Btu/hour (step 2) from the total Btu/hour (step 3). If the result is zero or less, no additional outside combustion air is required. If the result is greater than zero, go to step 5 (or see the opening size table below).
5. Calculate the minimum required size of the outdoor opening by dividing the remaining Btu/hour input (step 4) by 3000. The resulting size is square inches. This minimum area is a free area (see below).

Additional combustion air requirements:

1. Equipment clearances shall comply with the manufacturer's installation requirements. Clearances shall not be less than one inch on the sides and back and six inches from the front of the appliance.

2. The combustion air opening shall be located within the top 12 inches of the room or enclosure. The intent is to locate the opening as high as possible.
3. If the combustion air duct is routed horizontally to the exterior of the building, the duct shall not slope downward toward the source of combustion air. The duct may be horizontal or slope upwards towards the exterior of the building.
4. Where louvers or grilles are used on combustion air openings, the free area of the louver or grille must be used to meet the minimum required opening size calculated above. If the free area is not known, it shall be assumed that wood louvers have 25 percent free area and metal louvers and grilles have 75 percent free area.
5. The exterior side of the combustion air opening shall be covered with a ½ inch mesh steel screen.
6. Round combustion air ducts with a diameter of 14 inches or less shall be 30 gage (minimum) galvanized steel or 26 gage (minimum) aluminum in accordance with the mechanical code. For rectangular ducts and larger round ducts, consult the mechanical code.

Conditions created by mechanical exhaust:

Mechanical exhaust devices such as clothes dryers, range hoods, toilet exhaust fans, etc. have the potential to back draft natural draft and induced draft combustion appliances. If any exhaust device is located in the same space as a combustion appliance, or in a space freely communicating with the appliance, the combustion air opening must be adequately sized to provide both combustion air and makeup air for the exhaust device. A back draft check shall be performed with the exhaust device operating to ensure that the appliance is properly venting.

High capacity exhaust devices (such as a range hood exhaust fans rated at over 300 CFM), have the potential to back draft combustion appliances located in separate portions of the building. A back draft check shall be performed to verify proper operation of combustion appliances when high capacity exhaust devices are installed. If back draft occurs under any potential operational scenario, makeup air shall be provided for the high capacity exhaust device. The makeup air shall be interlocked with the exhaust device.

Sample calculations:

The following calculation is based on a 120,000 Btu/hour furnace, 65,000 Btu/hour water heater and a 30,000 Btu/hour unit heater located in a residential garage.

Garage dimensions: Length = 22 feet, Width = 22 feet, Height = 8 feet
 Volume = Length x Width x Height = 22 x 22 x 8
 Volume = 3,872 cubic feet

Maximum allowed Btu/hour = Garage volume x 1,000 Btu/hour / 50 cubic feet
 Maximum allowed Btu/hour = 3,872 x 1,000 / 50
 Maximum allowed Btu/hour = 77,440 Btu/hour

Total Btu/hour input = Furnace + Water Heater + Unit Heater
 Total Btu/hour input = 120,000 + 65,000 + 30,000
 Total Btu/hour input = 215,000 Btu/hour

Remainder = Total Btu/hour input - Maximum allowed Btu/hour
 Remainder = 215,000 – 77,440
 Remainder = 137,560 Btu/hour

Minimum opening size = Total Btu/hour input / 3000 Btu/hour/square inch
 Minimum opening size = 137,560 / 3000
 Minimum opening size = 45.8 square inches

Diameter of round duct = 2 x square root of (area / 3.14)
 Diameter of round duct = 2 x square root of (45.8 / 3.14)
 Diameter of round duct = 7.6 inches

Therefore an 8 inch diameter combustion air opening is required.

The following opening size table is included for convenience. Note that openings may be either rectangular or round. The minimum opening dimension is 3 inches.

Opening Diameter (inches)	Opening Area (square inches)	Gas Input (BTU/hour)
3	7.07	21,200
4	12.6	37,700
5	19.6	58,900
6	28.3	84,800
7	38.5	115,000
8	50.3	151,000
9	63.6	191,000
10	78.5	236,000
12	113	339,000
14	154	462,000

Ron Thompson, Building Official
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