Appendix 4.A

2008 Building Energy Efficiency Standards
Residential Indoor Air Quality and Mechanical Ventilation
(*ASHRAE 62.2*)

Minimum Best Practices Guide - Exhaust-Only Ventilation

Introduction:

The California Energy Commission has created the following guide to provide assistance in complying with *ANSI/ASHRAE Standard 62.2-2007, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings* (*ASHRAE 62.2*); which was adopted by reference into the *2008 Building Energy Efficiency Standards (Standards)*. *ASHRAE 62.2* was adopted to respond to concerns that reliance solely on operable windows is inadequate to provide ventilation in low-rise residential buildings. This, coupled with concerns about increasing levels of indoor contaminants and mold growth, has led to the need for mechanical ventilation.

The two main requirements of *ASHRAE 62.2* are (1) whole-building ventilation to maintain acceptable air quality, and (2) local intermittent exhaust fans in each kitchen and bathroom to reduce the levels of contaminants and moisture in these spaces.

The minimum best practices in this guide apply to residential low-rise newly constructed buildings and additions, including multi-family occupancies. The guide provides an exhaust-only approach acceptable for most residential projects needing to meet the *Standards*. Additional guidance in meeting the *Standards* may be obtained by calling the Energy Commission's *Standards* Hotline at (800) 772-3300.

Background:

The *2008 Building Energy Efficiency Standards* (*Standards*) require all newly constructed residential buildings to meet the requirements of *ANSI/ASHRAE Standard 62.2-2007, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings* (*ASHRAE 62.2*). In California, the requirements of *ASHRAE 62.2* also apply to additions over 1,000 square feet (sf) of conditioned floor area (CFA), and window operation is not allowed as a permissible method for providing whole-building ventilation (Section 150(o) of the *Standards*).

ASHRAE 62.2 is a health and safety measure developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) to enable dwellings to achieve acceptable indoor air quality. *ASHRAE 62.2* has been adopted in the *Standards* to respond to concerns that reliance solely on operable windows is inadequate to provide for ventilation in low-rise residential buildings. This, coupled with concerns about increasing levels of indoor contaminants and mold growth, has led to the need for mechanical ventilation. Implementation of these ventilation requirements will demand careful attention by builders and a focused review by enforcement agencies.

ASHRAE 62.2 specifies two mechanical ventilation airflow requirements - **Whole-Building Ventilation** and **Local Ventilation Exhaust**, and specifies criteria for prescriptive duct sizing for those ventilation systems. Other additional requirements are specified that affect indoor air quality. All applicable requirements must be met to demonstrate compliance with *ASHRAE 62.2*.

Whole-building ventilation is required to maintain acceptable air quality in a dwelling at all times. A switch is provided for controlling the operation of the fan. This allows the fan to be turned off when there are no occupants in the dwelling or when indoor air quality would be reduced when outdoor air is brought into the dwelling. The fan used for continuous ventilation must have a low sound rating in order to avoid having occupants switch off the fan to reduce the noise level. Local intermittent exhaust fans are required in all kitchens and bathrooms to reduce the level of contaminants and moisture in these spaces when they occur. These fans can be switched on and off when needed. The additional requirements are applied as applicable to the dwelling design in order to support and maintain the levels of indoor air quality provided by the whole-building and local intermittent ventilation systems.

Standards Section 10-103 requires the submittal of documentation on the building plans. Sufficient design information should be placed on the plans to demonstrate compliance with the applicable requirements of *ASHRAE 62.2* prior to issuance of a building permit. Appendix I of this guide provides sample calculations for airflow requirements and prescriptive fan and duct system sizing. Appendix II provides sample noteblocks that can be used to provide exhaust ventilation system design specifications that may be required by the enforcement agency to be included on the plans. Appendix III provides a sample Homeowner's Maintenance and Operation Form for use with this Guide. Appendix IV provides a summary checklist that may be helpful when designing a minimum best practice ventilation system.

The following minimum best practices apply to residential low-rise newly constructed buildings and additions, including multi-family occupancies. They have been developed to provide a design and construction "exhaust-only" ventilation approach acceptable for most residential projects needing to meet the *Standards*. *ASHRAE 62.2* allows compliance to be shown either through Prescriptive Ventilation System Inspection or Performance Ventilation System Testing. This guide does not include explanations for the use of other acceptable compliance alternatives in addition to "exhaust-only" ventilation, which are described in Section 4.6 of the *2008 Residential Compliance Manual*. Guidance for these other than "exhaust-only" alternative approaches, as well as additional information on the practices described below, may be obtained by calling the California Energy Commission's Energy Standards Hotline at (800) 772-3300.

Minimum Best Practices Guide

The following Minimum Best Practices Guide is a supplement to the *2008 Residential Compliance Manual* and can be used to demonstrate compliance with the ventilation requirements of *ASHRAE 62.2* and Section 150(o) of the *Standards*. The guide provides a summary of *ASHRAE 62.2* and a simplified exhaust-only approach for meeting its minimum ventilation requirements. If a statement in this Guide describes an action that must be completed for compliance with the *Standards*, there will be a box at the beginning of the statement that can be used to check off completed items, or to indicate "NA" for "not applicable" to this project for that item. An underlined blank space indicates that a value is required to be entered. When (Design) is shown adjacent to an item, that item should be considered during the design phase of the project. Appendix IV provides a summary checklist that may be helpful when designing a minimum best practice ventilation system, but does not replace the guide.

The exhaust-only ventilation approach is organized in four sets of requirements: general, whole-building ventilation, local ventilation exhaust, and other.

General Requirements:

☐ The ventilation system's design requirements are shown on the building design drawings utilizing noteblocks, sheet notes, schedules, or other means of written communication that describe the requirements for ventilation airflow, fan selection and room location, and duct sizing for Whole-Building Ventilation and Local Ventilation Exhaust. In all cases, Table 7.1 shall be placed on the plans to specify duct sizing requirements that must be met in the field to comply with *ASHRAE 62.2* exhaust-only ventilation. This makes it possible for changes to be made in the field to accommodate conditions that may not be known at the design/permit stage and still comply with the *ASHRAE 62.2* requirements. Documentation describing ventilation system controls and labeling, and other indoor air quality measures may also be required. See the sample noteblocks in Appendix II of this Guide. (Design)

☐ Prescriptive Ventilation System Inspection. Prior to final inspection, the ventilation system has been visually inspected by the contractor/installer to confirm that it meets the prescriptive duct sizing requirements and fan ratings given in Table 7.1 of *ASHRAE 62.2* (see Appendix I of this guide), and this information has been included on the Installation Certificate, (CF-6R-MECH-05);

OR

☐ Performance Ventilation System Testing. Prior to final inspection, the required minimum airflow has been confirmed by testing the delivered ventilation airflow of the installed system using a flow hood or other airflow measuring device, and this information has been included on the Installation Certificate (CF-6R-MECH-05).[1]

☐ An Installation Certificate (CF-6R-MECH-05) has been completed by the builder/installer, and is posted or available at the building site for final inspection. The builder/installer signature on the CF-6R-MECH-05 for the building certifies that the building complies with the ventilation and indoor air quality requirements of the *Standards*.

Whole-Building Ventilation Requirements [*ASHRAE 62.2*, Section 4]:

Whole-Building Ventilation provides outdoor air ventilation for the entire building as contrasted with Local Ventilation Exhaust for kitchens and bathrooms, which is discussed in the next section of this guide. The most common solution for compliance using the exhaust-only approach is expected to be the installation of a quiet ceiling-mounted bathroom exhaust fan, remote-mounted inline fan, or exterior-mounted exhaust fan. Either the airflow of a single fan or the sum of the airflows from multiple fans can be used to meet the whole-building total airflow requirement.

Compliance with the *Standards* can be shown by using either the prescriptive or the performance approach. If the performance approach is used, the Indoor Air Quality (IAQ) exhaust fan system must be specified as an input to the compliance software, and that system type reported on the performance CF-1R.[2] For the prescriptive compliance approach, specification of the ventilation system type is not required on the CF-1R.

☐ The *ASHRAE 62.2* whole-building airflow equation 4.1a (Appendix I, item I.1) has been used to calculate the required whole-building ventilation airflow rate, and it is indicated on the

[1] Note: Although not required, measurement of the actual system airflow is the recommended way to demonstrate compliance with the requirements of both whole-building ventilation and local ventilation exhaust.
[2] Exhaust ventilation system type terminology may vary with the different compliance software programs.

plans. For projects using the performance method of compliance, the required whole-building airflow rate is reported on the Certificate of Compliance (CF-1R). (Design)

The required whole-building airflow rate = _____ cfm

☐ For additions over 1,000 sf of conditioned floor area (CFA), the whole-building ventilation airflow rate has been calculated based on the CFA of the existing dwelling plus the addition. (Design)

☐ The ceiling mounted whole-building ventilation fan has a sound rating of one sone or less at the required ventilation airflow rate. (Design)

Note: *A remote-mounted inline fan, or exterior-mounted exhaust fan with a minimum of 4 feet of duct between the fan and intake grille, does not require a sound rating.*

☐ The exhaust fan control(s) used for whole-building continuous operation is labeled to communicate the required continuous building ventilation function and importance with a statement to make clear how the control (e.g., on/off switch) is to be operated. At a minimum, the label should communicate: "to maintain minimum levels of outside air ventilation required for good health, the fan control should be on at all times when the building is occupied, unless there is severe outdoor air contamination." It is recommended that the label text should be in bold type, placed on a white background, and no smaller than the equivalent of Arial 12 point type. (Design)

Sample: **To maintain minimum levels of outside air ventilation required for good health, the fan control should be on at all times when the building is occupied, unless there is severe outdoor air contamination.**

Systems for which compliance is confirmed to meet Prescriptive Ventilation System Inspection design criteria comply with the following:

☐ The exhaust fan(s) used for continuous whole-building ventilation is rated by the Home Ventilation Institute (HVI)[3] to provide at least the required ventilation rate at a minimum static pressure of 0.25 inches of water column (in. w.c.). (Design)

☐ The duct design for the whole-building ventilation system meets the requirements of Table 7.1 (Appendix I, item I.3). (Design)

Local Ventilation Exhaust Requirements [*ASHRAE 62.2*, Section 5]:

In addition to meeting the Whole-Building Ventilation Requirements discussed in the previous section, *ASHRAE 62.2* requires that each kitchen and bathroom have a local ventilation exhaust system installed that exhausts indoor air to outside the dwelling. The Local Ventilation Exhaust Requirements in one room can be met by a Whole-Building Ventilation exhaust system installed in that room (in this case Local Ventilation Exhaust systems would still have to be installed in other kitchens and bathrooms where the Whole-Building Ventilation exhaust system is not installed.) Use of operable windows is not allowed for meeting the local ventilation exhaust

[3] To select fans that meet these criteria, use the HVI certified fan products directory at www.hvi.org.

requirements in kitchens and bathrooms. Local ventilation exhaust systems may operate intermittently or continuously according to *ASHRAE 62.2*; however, at a minimum, this Guide assumes that intermittent exhaust fan operation is used, except for the case where an exhaust fan provides both the continuous exhaust to meet the Whole-Building Ventilation System Requirements and the Local Ventilation Exhaust Requirements in one room .

☐ The kitchen hood(s) deliver ventilation airflow at 100 or more cfm.[4,5] (Design)

☐ All bathroom exhaust fans deliver ventilation airflow at 50 or more cfm for each bathroom.[6] (Design)

☐ All ceiling mounted intermittent local ventilation fans have a sound rating of three sones or less at the required airflow rate.[7] (Design)

Note: *A remote-mounted inline fan or exterior mounted exhaust fan with a minimum of 4 feet of duct between the fan and intake grille do not require a sound rating.*

☐ All intermittent local ventilation exhaust fans have been designed to be operated as needed by the occupant. At a minimum, a wall switch may be used. Alternatively, some other type of control such as shut off timers, humidity sensors, or occupancy sensors may be used. (Design)

Systems for which compliance is confirmed to meet the Prescriptive Ventilation System Inspection design criteria must also comply with the following:

☐ All exhaust fans used for intermittent local ventilation are rated by the HVI to provide at least the required ventilation rate at a minimum static pressure of 0.25 in. w.c. (Design)

☐ All duct designs for intermittent local ventilation meet the requirements of Table 7.1 (Appendix I, item I.3). (Design)

Other Requirements [*ASHRAE 62.2*, Section 6]:

The items listed below (6.1 through 6.8) correspond to the "Other Requirements" of *ASHRAE 62.2*, Section 6, and all Section 6 requirements must be met. Other applicable *California Building Code* (*CBC*) requirements must also be met as noted. Refer also to Section 4.6.5 of the *2008 Residential Compliance Manual* for information describing these "Other Requirements".

6.1. Transfer Air

Dwelling units shall be designed and constructed to provide ventilation air directly from the outdoors and not as transfer air from adjacent dwelling units or spaces, such as garages, unconditioned crawl spaces, or unconditioned attics.

Section 6.1 does not prohibit whole-building exhaust or local exhaust ventilation systems and does not require mechanical systems to maintain pressure relationships with adjacent spaces except as specified in Section 6.4.

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[4] A kitchen [for purposes of indoor air quality requirements] is any room containing cooking appliances.
[5] Recirculating range hoods that do not exhaust pollutants to the outside cannot be used to meet the requirements of *ASHRAE 62.2*.
[6] A bathroom [for purposes of indoor air quality requirements] is considered a room containing a bathtub, shower, spa or other similar source of moisture. Note that a room containing only a toilet is not required to meet the Local Ventilation Exhaust Requirements.
[7] Fans that have a maximum rated airflow that exceeds 400 cfm do not require a sound rating.

☐ Measures consistent with the requirements of *Standards* Section 117 (Residential Compliance Manual Section 3.5) have been taken to prevent air movement between adjacent dwelling units (e.g., through party walls), and between the dwelling unit and other spaces that are either vertically or horizontally adjacent, such as garages, unconditioned crawl spaces, or unconditioned attics. All cracks, voids, and air leakage points have been filled; and all seams in plasterboard surfaces have been taped and sealed. (Design)

6.2 Instructions and Labeling

Compliance, operating, maintenance, and ventilation information on the ventilation approach being used and the expected performance of the system must be provided to the dwelling owner as specified in Section 10-103(b) of the *Standards*. This information can be in paper or electronic format.

☐ Compliance forms and system manuals, brochures and cut sheets, or other ventilation system information have been provided to the dwelling owner to describe proper operation and maintenance of the system, the approach being used for ventilation, the expected system performance and required actions to maintain system performance, including the Minimum Efficiency Reporting Value (MERV) filter requirements in Section 6.7 of this guide.

Note: *The ASHRAE Homeowner's Operations and Maintenance Documentation form presented in Appendix III may be used to provide some of the required information.*

Note: *The labeling requirements for the whole-building ventilation control are described in the* Whole-building Ventilation Requirements *section of this Guide.*

6.3 Clothes Dryers

☐ All clothes dryers must be exhausted directly to the outdoors (*California Mechanical Code* [*CMC*] 905.2). (Design)

6.4 Combustion and Solid-Fuel Burning Appliances

☐ Combustion and solid-fuel burning appliances are provided with adequate combustion and ventilation air, and vented in accordance with the appliance manufacturer's installation instructions and the *CMC*.

☐ If an atmospherically vented appliance (e.g., gas furnace or water heater), or solid fuel appliance (e.g., fireplace) is inside the building pressure boundary, the total net exhaust of the two largest exhaust fans (with both fans operating at full capacity) does not exceed 15 cfm per 100 sf of occupiable space. (Design)

6.5 Garages

☐ To prevent migration of contaminants from the garage to adjacent occupiable spaces, and in addition to the requirements specified in 6.1, doors between the garage and dwelling unit are gasketed and weather stripped. (Design)

☐ HVAC systems that include air handlers or return ducts located in the garage, have been sealed to less than 6 percent of total fan airflow and verified by a HERS rater as specified by *Standards* Section 151(f)10. (Design)

6.6 Ventilation Opening Area[8] (for operable windows, skylights, through-the-wall-inlets, or other operable openings to the outside)

☐ Habitable spaces have an operable ventilation opening area equal to at least 4% of the room floor area (sf), but not less than 5 sf. For habitable spaces where it is not possible to provide the minimum Ventilation Opening Area to the outside, the opening to the adjoining rooms is unobstructed as specified in Section 1203.4.1.1. of the *CBC*, and the dwelling total operable opening area to the outdoors, based on the total occupiable floor area, meets the requirements of Section 1203.4.1 of the CBC. (Design)

☐ Toilet and utility rooms have ventilation openings with an operable area of not less than 4% of the room floor area (sf), nor less than 1.5 sf. Toilet and utility rooms that meet Local Ventilation Exhaust Requirements are not required to meet this Ventilation Opening Area requirement. Utility rooms with ducted dryer exhaust and toilet compartments in bathrooms are also not required to meet the minimum Ventilation Opening Area requirement. (Design)

6.7 Minimum Filtration

☐ Mechanical systems that supply air to an occupiable space through ductwork exceeding 10 feet in length and through a thermal conditioning component (e.g., heating/cooling coil) are provided with a filter having a minimum efficiency rating of MERV 6. The air filter provided is selected and sized to operate at a clean filter pressure drop no greater than 0.1 in. w.c.. The filter is installed in a manner that makes it accessible to the occupant for regular maintenance, consistent with *CMC* Section 305. (Design)

☐ Information describing the air filter selected for the building ventilation system, its location, maintenance, and replacement requirements are included in the compliance, operation, maintenance, and ventilation information provided to the owner according to Section 6.2 above.

6.8 Air Inlets (all operable ventilation openings)

☐ Any air inlets that are part of the ventilation design are located a minimum of 10 feet from known sources of contamination, such as stack, vent, exhaust hood, or vehicle exhaust. (Design)

☐ Ventilation openings (such as windows) are readily accessible and readily controllable by the building occupants consistent with the *CBC* (1203.4). (Design)

☐ Where ventilation openings are covered by louvers or are otherwise obstructed, the openable area is based on the free unobstructed area through the opening. (Design)

Note: *For additional information concerning these "Other Requirements," including any additional exceptions that may not have been covered in this Minimum Best Practice Guide, refer to the Residential Compliance Manual or contact the Energy Standards Hotline at (800) 772-3300.*

[8] Ventilation openings must be provided to serve as back-up ventilation if the mechanical ventilation system becomes disabled (e.g., power failure).

Appendix I: Fan and Duct Sizing Calculations

The process for exhaust-only ventilation system design is to: (1) determine the minimum amount of airflow required: (2) select a fan or multiple fans that are rated to provide ventilation airflow that equals or exceeds the minimum required; and (3) design and install a ventilation duct system that meets the requirements of *ASHRAE 62.2* Table 7.1.

(I.1) Whole-Building Ventilation Requirement Calculations

Equation 4.1a (from *ASHRAE 62.2*):

$$Q_{fan} = 0.01xA_{floor} + 7.5x(N_{br} + 1)$$

Where:

A_{floor} = conditioned floor area, ft²
N_{br} = number of bedrooms; not to be less than one
Q_{fan} = ventilation airflow requirement = minimum fan airflow rating, (cfm)

Example:

2,500 sf CFA house with 5 bedrooms
$Q_{fan} = 0.01x2500 + 7.5x(5 + 1) = 70$ cfm

(I.2) Local Ventilation Exhaust Requirement Calculations

This Minimum Best Practices Guide provides information for intermittent fan operation only for local ventilation exhaust systems. The minimum airflow rates for intermittent local ventilation exhaust are specified in Table 5.1 of *ASHRAE 62.2*. The required minimum intermittent local ventilation exhaust airflow rate for bathrooms is 50 cfm. The minimum intermittent ventilation exhaust airflow rate for kitchens is 100 cfm.

(I.3) Prescriptive Duct Sizing Calculations

Prescriptive duct sizing can be utilized to demonstrate compliance with the ventilation airflow requirement through inspection of the installed whole-building ventilation system, or local ventilation exhaust system, to confirm conformance with the requirements of Table 7.1. Instructions for the use of Table 7.1 and example calculations are provided below.

TABLE 7.1 PRESCRIPTIVE DUCT SIZING REQUIREMENTS (FROM *ASHRAE 62.2*)								
Duct Type	Flex Duct				Smooth Duct			
Fan Rating (cfm at 0.25 in. w.g.)	50	80	100	125	50	80	100	125
	Maximum Allowable Duct Length (ft)							
Diameter, (in)	Flex Duct				Smooth Duct			
3	X	X	X	X	5	X	X	X
4	70	3	X	X	105	35	5	X
5	NL	70	35	20	NL	135	85	55
6	NL	NL	125	95	NL	NL	NL	145
7 and above	NL	NL	NL	NL	NL	NL	NL	NL
This table assumes no elbows. Deduct 15 ft of allowable duct length for each turn, elbow, or fitting. Interpolation and extrapolation in Table 7.1 is not allowed. For fan rating values not listed, use the next higher value. This table is not applicable for fan ratings > 125 cfm. NL = no limit on duct length of this size. X = not allowed, any length of duct of this size with assumed turns and fittings will exceed the rated pressure drop (0.25 in w.g.). Note: water gauge (w.g). is the same as water column (w.c.)								

a) Determine the duct material that will be used for the installation (smooth or flex). Duct sizing will use the Table 7.1 columns under the selected type of duct.

b) Identify the fan rating(s) used to provide whole-building and local ventilation exhaust (cfm).

c) Select the column that corresponds to the required fan rating for the system. If the required fan rating (airflow cfm) is not shown on the chart and falls between columns, use the next highest fan rating column for determining the duct length and diameter. The Table is not applicable to fan ratings greater than 125 cfm.

d) Select the preferred duct diameter to determine the corresponding maximum allowable duct length from the fan rating column for each exhaust fan. For each turn, elbow or fitting in the duct run, subtract 15 feet of length from the allowable duct length specified in the Table. If the allowable length of (straight) duct is not sufficient for the design, select the next higher diameter of duct, and recalculate the allowance. An "NL" in the table indicates that any length of duct for that diameter is in compliance.

Examples:

Example 1: For a 50 cfm fan using 4” flex duct, the length can be a maximum of 70 feet (ft) of straight duct without elbows.

Example 2: For an 80 cfm fan using 4” flex duct, the length would be limited to 3 ft of straight duct without elbows.

Example 3: For the Equation 4.1a example shown above in Appendix I, item I.1, assume smooth duct will be used, there will be 3 elbows, and there is 40 ft. of straight duct required to run a duct from the fan to the exterior of the building. The determined fan rating (70 cfm) is not on the chart, so use the next highest column that is greater than 70 cfm – use the 80 cfm column. Since the system requires 3 elbows, 45 ft. must be subtracted from the values in the table. For smooth ducts in the 80 cfm column, 4-inch duct has a maximum allowable duct length of 35 ft. (too short). 5-inch duct has an allowable straight length of 135 ft. from which the allowance for elbows (3 x 15 = 45 ft) must be subtracted (135 – 45 = 90 ft.). Since the allowable length (90 ft.) is greater than the required length (40 ft) this combination of duct material, duct diameter, duct length and number of elbows meets the Table 7.1 duct sizing requirement.

Appendix II: Sample Noteblocks

Noteblocks, sheet notes, schedules or other forms of written communication that specify the requirements for ventilation airflow, the rooms where the whole-building and local ventilation exhaust fans are located, and duct sizing for Whole-Building Ventilation and Local Ventilation exhaust shall be specified on the plans submitted to the enforcement agency for a building permit. However, in all cases, Table 7.1 shall be placed on the plans to allow for duct changes that may be required during construction of the system.

The following sample noteblocks may be placed on the building design plans to meet the requirements for submittal of the ventilation system specifications to the enforcement agency.

WHOLE-BUILDING VENTILATION REQUIREMENTS (FROM *ASHRAE 62.2*)		
AT LEAST ONE MECHANICALVENTILATION SYSTEM IN THE BUILDING MUST BE DESIGNATED FOR USE IN COMPLIANCE WITH THE WHOLE-BUILDING VENTILATION REQUIREMENT. ALTERNATIVELY, THE SUM OF THE RATED AIRFLOWS FROM MULTIPLE FANS CAN BE UTILIZED TO MEET THE REQUIRED WHOLE-BUILDING VENTILATION AIRFLOW. THE SYSTEM(S) MUST DELIVER CONTINUOUS VENTILATION AIRFLOW AT A RATE GREATER THAN OR EQUAL TO THE RATE SPECIFIED IN EQUATION 4.1 a, AND FAN SONE RATINGS MUST NOT EXCEED 1.0. FOR DWELLING OCCUPANT DENSITIES KNOWN TO BE GREATER THAN (N_{BR} + 1), THE RATE SHALL BE INCREASED BY 7.5 CFM FOR EACH ADDITIONAL PERSON.		
(Eq. 4.1a) $Q_{fan} = 0.01A_{floor} + 7.5(N_{br} + 1)$	Where: A_{floor} = conditioned floor area, ft^2 N_{br} = number of bedrooms; not to be less than one Q_{fan} = ventilation air requirement = fan flow rate, (cfm)	Eq 4.1a Calculation: A_{floor} = N_{br} = Q_{fan} =

LOCAL VENTILATION EXHAUST REQUIREMENTS (FROM *ASHRAE 62.2*)		
LOCAL MECHANICAL EXHAUST FANS SHALL BE INSTALLED IN EACH KITCHEN AND BATHROOM ACCORDING TO THE REQUIREMENTS OF *ASHRAE 62.2*. THE MINIMUM AIRFLOW RATES SHALL BE GREATER THAN OR EQUAL TO THE AMOUNT INDICATED IN TABLE 5.1 BELOW AND FAN SONE RATINGS MUST NOT EXCEED 3.0.		
TABLE 5.1 **MINIMUM INTERMITTENT LOCAL VENTILATION EXHAUST AIRFLOW RATES**		
APPLICATION	AIRFLOW	NOTES
KITCHEN	100 CFM	VENTED RANGE HOOD REQUIRED IF EXHAUST FAN FLOWIS LESS THAN 5 ACH.* IF THE RANGE HOOD IS USED FOR LOCAL EXHAUST IT MUST BE VENTED TO THE OUTDOORS
BATHROOM	50 CFM	

* Air Changes per Hour (ACH), which is determined by multiplying the volume of the space by five (5) ACH = cubic feet per hour, and then dividing by 60 minutes per hour to determine the cubic feet per minute (cfm).

PRESCRIPTIVE DUCT SIZING REQUIREMENTS (FROM *ASHRAE 62.2*)

IN ORDER TO COMPLY WITH THE PRESCRIPTIVE DUCT SIZING REQUIREMENTS OF *ASHRAE 62.2*, A VENTILATION FAN MUST BE SELECTED THAT IS RATED TO PROVIDE AT A MINIMUM THE REQUIRED VENTILATION AIRFLOWAT 0.25 IN. W.G. AND THE DUCTS MUST BE SIZED IN ACCORDANCE WITH THE SPECIFICATIONS GIVEN IN TABLE 7.1, BELOW.

TABLE 7.1

Duct Type	Flex Duct				Smooth Duct			
Fan Rating (cfm at 0.25 in. w.g.)	50	80	100	125	50	80	100	125
	Maximum Allowable Duct Length (ft)							
Diameter, (in)	Flex Duct				Smooth Duct			
3	X	X	X	X	5	X	X	X
4	70	3	X	X	105	35	5	X
5	NL	70	35	20	NL	135	85	55
6	NL	NL	125	95	NL	NL	NL	145
7 and above	NL	NL	NL	NL	NL	NL	NL	NL

This table assumes no elbows. Deduct 15 ft of allowable duct length for each turn, elbow, or fitting. Interpolation and extrapolation in Table 7.1 is not allowed. For fan ratings not listed, use the next higher value. This table is not applicable for fan ratings > 125 cfm.
NL = no limit on duct length of this size.
X = not allowed, any length of duct of this size with assumed turns and fittings will exceed the rated pressure drop (0.25 in w.g.)
Note: water gauge (w.g). is the same as water column (w.c.)

OTHER REQUIREMENTS FOR INDOOR AIR QUALITY (FROM *ASHRAE 62.2*)

THE BUILDING MUST COMPLY WITH THE “OTHER REQUIREMENTS” SPECIFIED IN *ASHRAE 62.2* SECTIONS 6.1 THROUGH 6.8.

6.1 TRANSFER AIR
6.2 INSTRUCTIONS AND LABELING
6.3 CLOTHES DRYERS
6.4 COMBUSTION AND SOLID-FUEL BURNING APPLIANCES
6.5 GARAGES
6.6 VENTILATION OPENING AREA
6.7 MINIMUM FILTRATION
6.8 AIR INLETS

Appendix III: Homeowner's Operations and Maintenance Documentation Form

(*ASHRAE 62.2*)

HOMEOWNERS OPERATIONS AND MAINTENANCE DOCUMENTATION FORM

Installer Information:

Company Name _____ Date Installed: _____

Address _____ Date Serviced: _____

_____ Date Serviced: _____

_____ Date Serviced: _____

Phone: _____ Date Serviced: _____

Whole-Building Ventilation System Type: _____

_____

_____

Whole-Building Ventilation Operating Instructions and Schedule: _____

_____

_____

_____

Required Maintenance (annual or seasonal recommended as a minimum):

_____

_____

_____

Ventilation Equipment and/or Devices:

Equipment	Model	Manufacturer
_____	_____	_____
_____	_____	Phone: _____
_____	_____	_____
_____	_____	Phone: _____
_____	_____	_____
_____	_____	Phone: _____
_____	_____	_____
_____	_____	Phone: _____
_____	_____	_____
_____	_____	Phone: _____
_____	_____	_____
_____	_____	Phone: _____

Appendix IV: Summary Checklist for *ASHRAE 62.2* Minimum Best Practices Guide Exhaust-Only Ventilation

General Requirements:

☐ Design requirements shown on building design drawings
☐ Compliance with the ventilation airflow requirements demonstrated by:
  ☐ Prescriptive Ventilation System Inspection. Visually inspecting prescriptive duct sizing and fan ratings

  OR

  ☐ Performance Ventilation System Testing. Testing to confirm the delivery of the minimum ventilation airflow
☐ Complete, sign and make an Installation Certificate (CF-6R-MECH-05) available at the site

Whole-Building Ventilation:

☐ Whole-building exhaust ventilation system meets the required whole-building ventilation airflow, which is _____ cfm
☐ Whole-building exhaust fan(s) has a sound rating of one sone or less at the required ventilation airflow rate
☐ Whole-building exhaust fan control(s) is labeled as to function and importance
For systems complying with the Prescriptive Ventilation System Inspection requirements:
☐ Whole-building exhaust fan(s) is rated to provide at least the minimum ventilation rate at a minimum static pressure of 0.25" w.c.
☐ Whole-building ventilation duct design meets requirements of Table 7.1

Local Ventilation Exhaust:

☐ Kitchen hood delivers ventilation airflow of at least 100 cfm
☐ Kitchen fan(s) exhausted to exterior
☐ All bathroom exhaust fans deliver ventilation airflow of at least 50 cfm for each bathroom
☐ All local exhaust fans have a sound rating of three sones or less at the required ventilation airflow rate
☐ All intermittent local exhaust fans have been designed to be operated as needed by the occupant (such as wall switch, shut-off timer, humidistat or occupancy sensor)
For systems complying with the Prescriptive Ventilation System Inspection requirements:
☐ All local exhaust fans are rated to provide at least the minimum ventilation rate at a minimum static pressure of 0.25" w.c.
☐ All local ventilation duct designs meet the requirements of Table 7.1

Other Requirements:

6.1 Transfer Air

☐ Measures have been taken to prevent air movement between dwelling units and between dwelling units and other adjacent spaces.

6.2 Instructions and Labeling

☐ Compliance forms and information describing the approach, operation, maintenance and expected performance of the ventilation system has been provided to the owner.

6.3 Clothes Dryers

☐ All clothes dryers are exhausted directly to the outdoors.

6.4 Combustion and Solid-Fuel Burning Appliances

☐ If atmospherically-vented or solid-fuel appliances are inside the building pressure boundary, the total net exhaust of the two largest exhaust fans (at full capacity) does not exceed 15 cfm per 100 sf of occupiable space.

6.5 Garages

☐ In addition to 6.1, doors between garage and dwelling unit must be gasketed and weather stripped.

☐ HVAC systems with air handlers or return ducts in the garage are sealed to less than 6% leakage of total fan airflow and verified by HERS rater.

6.6 Ventilation Opening Area (for operable windows, skylights, through-the-wall-inlets, or other operable openings to the outside)

☐ Habitable spaces have a ventilation opening area no less than 4% of room floor area nor less than 5 sf.

☐ Toilet and utility rooms not meeting local exhaust ventilation requirements have operable window area no less than 4% of room floor area nor less than 1.5 sf.

6.7 Minimum Filtration

☐ Mechanical systems supplying air to occupiable space through a thermal conditioning component (e.g., heating/cooling coil) and with duct run greater than 10 ft must have a filter:

- ☐ With a minimum efficiency of MERV 6.
- ☐ Sized to operate with a clean filter pressure drop no greater than 0.1” w.c.
- ☐ Information provided to owner that describes filter location, maintenance and replacement requirements.

6.8 Air Inlets (all operable ventilation openings)

☐ Any air inlets that are part of the ventilation system are located a minimum of 10 ft away from known sources of contamination (e.g., stack, vent, exhaust hood, or vehicle exhaust).

☐ Ventilation openings are readily accessible and controllable by occupant.

☐ Where ventilation openings are covered or obstructed, the openable area is based on the free, unobstructed area through the opening.