

Dwelling Ventilation Strategies, Including ASHRAE 62.2

National Weatherization Conference
2005

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ASHRAE 62.1 – 2001 Ventilation for Acceptable Indoor Air Quality

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ASHRAE 62.1 - 2001

- ASHRAE 62.1 – *Ventilation for Acceptable Indoor Air Quality* – has been used by many weatherization programs for more than a decade.
- It is was predominantly a commercial standard with a small residential section.
- It was the basis for the Building Tightness Limit guidelines (BTL and BTLa).

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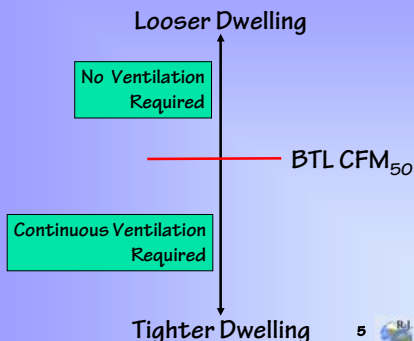
ASHRAE 62.1 - 2001

- The Building Tightness Limit (BTL) is the threshold CFM₅₀ value, i.e., if we make the dwelling any tighter than the BTL, whole building, continuously operating ventilation is required by ASHRAE 62.1.
- Does not require local exhaust in kitchen or bathrooms if there are operable windows.*

*Kitchen: 100 CFM on-demand, 25 CFM continuous, or operable windows.
*Bathroom: 50 CFM on-demand, 20 CFM continuous, or operable windows.

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ASHRAE 62.1 - 2001



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ASHRAE 62.1 - 2001


- The BTL is based on the ASHRAE 62.1 requirements of:
 - 0.35 Air Changes per Hour (ACH), but not less than
 - 15 CFM of outdoor air per person.

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ASHRAE 62.1 - 2001


- The Building Tightness Limit (BTL) has been computed in a number of ways by weatherization programs, including:
 - Single BTL for all dwellings.
 - BTL based on tables.
 - Programmable calculator.
 - Computer.

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ASHRAE 62.1 - 2001

- Many state Wx programs have intentionally avoided tightening dwellings below the BTL.
 - This practice avoids the need for whole building, continuously operating ventilation.
 - BTL is not necessarily the most cost-effective tightness level for a dwelling, but it gets us in the right neighborhood.

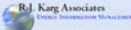
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ASHRAE 62.1 - 2001

- The BTL methods gives us a way to express compliance with ASRHAE 62.1 - 2001 in terms of CFM₅₀. However, there are uncertainties with this method:
 - Although a blower door test is reliable when repeated, converting from leakage at 50 Pascals to natural air leakage (ACH) is an uncertain process.
 - Natural air leakage (ACH) estimates are uncertain by as much as a factor of two.


BTLa procedure

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ASHRAE 62.2 - 2004

Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

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ASHRAE 62.2 - 2004

- This new IAQ standard applies to single-family and multifamily residential buildings of three stories or fewer above grade, including manufactured and modular houses.

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ASHRAE 62.2 - 2004

- Advantages of adopting:
 - Better indoor air quality for clients.
 - Fewer moisture problems with Wx homes.
 - Reduced agency and program liability.
 - Adherence to latest peer-reviewed IAQ standard.
- Disadvantages of adopting:
 - Increased cost of compliance compared with the previous IAQ standard, ASHRAE 62-2001.

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ASHRAE 62.2 - 2004

- Trade-off issue
 - ASHRAE 62.2 usually requires lower fan CFM which has a lower impact on the final negative pressure in the dwelling.
 - However, more dwellings require whole building ventilation with ASHRAE 62.2 than with 62.1.

Adoption of 62.2 by Wx Programs

- Wisconsin adopted in during the second half of 2005 after an in-field pilot study.
 - Number of dwellings requiring ventilation has increased.
 - Required ventilation flow has decreased.
 - Auditors find it easier to determine ventilation rates at an earlier time in the Wx process, so production can be planned more effectively.

ASHRAE 62.2-2004

- Whole building ventilation:
 - “A mechanical exhaust system, supply system, or combination thereof shall be installed for each dwelling unit to provide whole-building ventilation. . .”
 - Ventilation based on the table on next slide.
 - These CFM requirements are for whole building continuous ventilation.

Source: ASHRAE 62.2-2004, page 4

ASHRAE 62.2-2004, Table 4.1a

Minimum Ventilation Air Requirements, CFM, New Buildings

Floor Area (ft ²)	Bedrooms				
	0-1	2-3	4-5	6-7	>7
<1500	30	45	60	75	90
1501 - 3000	45	60	75	90	105
3001 - 4500	60	75	90	105	120
4501 - 6000	75	90	105	120	135
6001 - 7500	90	105	120	135	150
>7500	105	120	135	150	165

$$Q_{fan} = 0.01A_{floor} + 7.5(N_{bedroom} + 1)$$

ASHRAE 62.2-2004

- Or, use $Q_{fan} = 0.01A_{floor} + 7.5(N_{bedroom} + 1)$
 - Assumes two occupants in master bedroom and one in the other bedrooms. Over this density, increase ventilation by 7.5 cfm/person.
 - Whole building, intermittently operating ventilation may be used under some conditions for compliance.
 - Ventilation air must come directly from the outdoors.
 - Credit is allowed for envelope air leakage in some cases, based on ASHRAE 62.2 and 136.

A = conditioned floor area; "the part of the building that is capable of being thermally conditioned for the comfort of occupants." (ASHRAE 62.2, p.3)

ASHRAE 62.2-2004

- Local exhaust fans must be installed in bathrooms and kitchen.
 - Bathrooms
 - 50 CFM on-demand, or
 - 20 CFM continuous.
 - Kitchen
 - 100 CFM on-demand*, or
 - 5 ACH, based on kitchen volume.
 - 12' x 14' x 7.5' kitchen requires 105 CFM.

*Vented range hood required if exhaust fan flow rate is less than 5 kitchen air changes per hour.

ASHRAE 62.2-2004

- Dryers must be vented.
- When occupiable space adjoins a garage, the design must prevent migration of contaminants.
 - Zone pressure diagnostics helps here.
- Continuous fans must be rated at one or more or less.
- Local, on-demand fans must be rated at three or more or less.

ASHRAE 62.2-2004

- Infiltration credit calculation for dwellings “built prior to the application of this standard”.¹ This means Wx program dwellings.

If:
Natural Infiltration > 2A/100
Then:
Infiltration credit = 0.5 (Natural Infiltration - 2A/100)

A = occupiable floor area in ft²

ASHRAE 62.2-2004

- The whole building ventilation requirements of the Standard may be satisfied by **intermittent ventilation**, but in some cases, this is not a viable alternative because:
 - May require high CFM fan flow rates.
 - Control of fans must provide consistent percentage on-times.

Airetrack™ by Tamarack

A control for whole building intermittent fans



Air Flow adjustable from 40 to 100% of capacity in 16 increments for background ventilation rate.

Built-in Timer programmed at installation in multiples of 5 minutes for a 12 or 24 hour cycle.

Boost to full speed for 20 minutes by pressing button. Pressing again drops speed to background rate.

Local and/or Whole Building Ventilation Options

Ventilation Options

- Exhaust only – whole building and/or local.
 - Fan(s) installed in vented room.
 - Inline fan in remote location with ductwork.
- Supply only – whole building and/or local.
 - Fan(s) installed in vented room.
 - Inline fan in remote location with ductwork.
- Balanced – whole building and local
 - Heat recovery or no heat recovery.

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Panasonic Inline Fans



Panasonic ideas for life

ClubPanasonic rebates & promo

All Whisper Line™ Fans




COMPARE	Model #	Description
<input type="checkbox"/>	EV-10NLF1	Whisper Line™ 120 CFM In-Line Fan
<input type="checkbox"/>	EV-20NLF1	Whisper Line™ 240 CFM In-Line Fan
<input type="checkbox"/>	EV-30NLF1	Whisper Line™ 340 CFM In-Line Fan
<input type="checkbox"/>	EV-40NLF1	Whisper Line™ 440 CFM In-Line Fan

Appropriate for whole building ventilation.

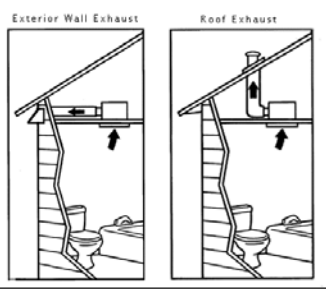
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Fantech Exhaust Fans








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Panasonic Exhaust Fans

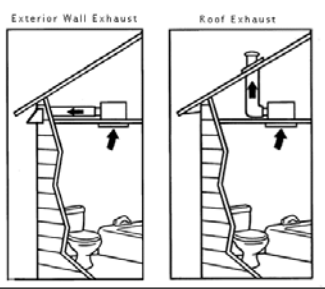
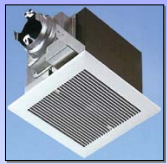



Whole building ventilation may be provided by bathroom or kitchen fan.

Dwelling Ventilation Strategies, Including ASHRAE 62.2

Panasonic Exhaust Fans

Dwelling Ventilation Strategies, Including ASHRAE 62.2

Panasonic Exhaust Fans

All Whisper Ceiling™ Fans



COMPARE	Model #	Description
<input type="checkbox"/>	EC-05VQ2	Whisper Ceiling™ 60 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-07VQ2	Whisper Ceiling™ 70 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-08VQ2	Whisper Ceiling™ 80 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-11VQ2	Whisper Ceiling™ 110 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-11VQ02	Whisper Ceiling™ 2-Speed 110/90 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-15VQ2	Whisper Ceiling™ 150 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-20VQ2	Whisper Ceiling™ 190 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-20VQ2	Whisper Ceiling™ 290 CFM Ceiling Mounted Fan
<input type="checkbox"/>	EC-40VQ2	Whisper Ceiling™ 380 CFM Ceiling Mounted Fan

FV-08WQ1
Whisper Wall™ 70 CFM Wall Mounted Fan

See dealer for price

[How to buy](#)
[Find a dealer](#)

Features	Support & Resources
Static Pressure in inches w.g.	0.03
Air Volume (CFM)	70 (54 at 0.25" static pressure)
Noise (sones)	1.1
Power Consumption (watts)	18 at 0.03" static pressure
Energy Efficiency (CFM's/Watt)	3.9

Dwelling Ventilation Strategies, Including ASHRAE 62.2

Nutone Exhaust Fans

Ultra-QuietTest Fans By Nutone



Nutone L S50 Ultra-QuietTTest 50 CFM Quiet Ceiling Vent Fan
\$89.58



Nutone L S80 Ultra-QuietTTest 80 CFM Quiet Ceiling Vent Fan
Regular Price: \$95.32
Sale Price: \$79.50



Nutone L S100 Ultra-QuietTTest 110 CFM Quiet Ceiling Vent Fan
\$102.22



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Kitchen Exhaust Fans



100 CFM, or
5 ACH of kitchen volume.
Wisconsin using Venmar S1311LS range hood with 40 CFM background & 75, 160, and 270 CFM high speeds.



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Whole Building Ventilation Control

- Always on, continuous operation (variable speed feature is important).
- Tamarac Airetrack™, continuous or intermittent operation (has variable speed feature).
- Timed switch operated by occupant?

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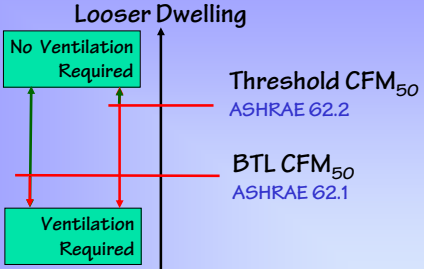
ASHRAE 62.1 vs. ASHRAE 62.2: Some Modeled Results

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Comparison of ASHRAE 62.1 & 62.2

Looser Dwelling



Tighter Dwelling

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Dwelling Ventilation Strategies, Including ASHRAE 62.2

Comparison of ASHRAE 62.1 & 62.2

Example 1

House of 1000 ft²
3 bedrooms (4 occ.)
CFM₅₀ = 1200
Weather factor = 0.78

<p>ASHRAE 62.1 - 2001</p> <p>BTL = 1110 CFM₅₀ BTLa = 1415 CFM₅₀ Cont. Vent = 18 CFM</p>	<p>ASHRAE 62.2 - 2004</p> <p>Threshold = 2359 CFM₅₀ Cont. Vent = 25 CFM 50% Vent = 50 CFM*</p>
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Click 2 *As long as system runs at least once every three hours, otherwise requires 100 CFM

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Comparison of ASHRAE 62.1 & 62.2

Example 2

House of 2000 ft²
3 bedrooms (4 occ.)
CFM₅₀ = 1300
Weather factor = 0.78

<p>ASHRAE 62.1 - 2001</p> <p>BTL = 1381 CFM₅₀ BTLa = 1912 CFM₅₀ Cont. Vent = 60 CFM</p>	<p>ASHRAE 62.2 - 2004</p> <p>Threshold = 2872 CFM₅₀ Cont. Vent = 38 CFM 50% Vent = 76 CFM*</p>
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Click 2 *As long as system runs at least once every three hours, otherwise requires 152 CFM

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Comparison of ASHRAE 62.1 & 62.2

Example 3

House of 2400 ft²
 4 bedrooms (5 occ.)
 CFM₅₀ = 1600
 Weather factor = 0.78

ASHRAE 62.1 - 2001 BTL = 1658 CFM ₅₀ BTL _a = 2294 CFM ₅₀ Cont. Vent = 68 CFM	ASHRAE 62.2 - 2004 Threshold = 3503 CFM ₅₀ Cont. Vent = 46 CFM 50% Vent = 92 CFM*
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Click 2 *As long as system runs at least once every three hours, otherwise requires 184 CFM 37 


Dwelling Ventilation Strategies, Including ASHRAE 62.2

Comparison of ASHRAE 62.1 & 62.2

Example 4
 (same as # 3, but looser)

House of 2400 ft²
 4 bedrooms (5 occ.)
 CFM₅₀ = 2294
 Weather factor = 0.78

ASHRAE 62.1 - 2001 BTL = 1658 CFM ₅₀ BTL _a = 2294 CFM ₅₀ Cont. Vent = 0 CFM	ASHRAE 62.2 - 2004 Threshold = 3503 CFM ₅₀ Cont. Vent = 30 CFM 50% Vent = 60*
--	--

Click 2 *As long as system runs at least once every three hours, otherwise requires 120 CFM 38 

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ASHRAE 62.2-2004

If we adopt this new IAQ standard, what will it mean for our weatherization programs?

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Ramifications for Weatherization


- Building Tightness Limits are no longer viable.
 - Threshold values are usually too high.
- Dwelling tightening limits now based only on:
 - Cost effectiveness.
 - Combustion safety.
- Whole building ventilation will have to be installed in most weatherized homes for compliance with 62.2 Standard.

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Dwelling Ventilation Strategies, Including ASHRAE 62.2

So, if You Adopt 62.2-2004. . .

1. Stop using the building tightness limit (BTL) methods.
2. Use different method for a tightness limit.
 - a. Depressurization Tightness Limit (DTL) for pre-Wx determination tightening limit.
 - b. Use weatherization cost-effective guidelines (WCEG) during Wx work.

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So, if We Adopt 62.2-2004. . .

3. Try to mitigate discovered sources of indoor air quality problems.
4. Check for tightness of ducts in any attached or tuck-under garages. Seal if necessary.
5. Check tightness of pressure boundaries between house and garages. Seal if necessary.
6. Try to satisfy whole building ventilation requirement with bathroom or kitchen fan.
 - a. Try to use continuous operation. If use intermittent, operate at least once every 3 hours.

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So, if We Adopt 62.2-2004. . .

7. Satisfy the local ventilation requirements of bathroom (and kitchen?).
8. Vent the dryer to outdoors.
9. Perform worst-case draft test.
10. If must replace any combustion appliances, try to install direct-vent.

Relax These 62.2 Requirements

- If new ventilation fans are installed, they should meet the same requirements, but existing fans should not be replaced only because they are too loud.
- Local kitchen ventilation.
- Particle filtration requirement should be relaxed or ignored for weatherization work.

Suggested Work/Design Flow

- 1) Inventory existing viable fans.
- 2) Estimate post-weatherization CFM₅₀ of dwelling.
- 3) Satisfy local bathroom (and kitchen?) exhaust requirements.
 - Bathrooms
 - 50 CFM on-demand, or
 - 20 CFM continuous.
 - Kitchen
 - 100 CFM on-demand, or
 - 5 ACH, based on kitchen volume.

Suggested Work/Design Flow

- 4) Size whole building ventilation fan with new building formula, Table 4.1a. This is the maximum ventilation the dwelling will need.
 - Continuous operation.
 - Intermittent, but running at least once every 3 hours.
- 5) Whole building ventilation might be satisfied by one of the local, on-demand exhaust fans in kitchen or bathroom.
- 6) After weatherization is completed, determine required CFM of whole building ventilation fan.

Suggested Work/Design Flow

- 7) Set exhaust fan CFM, if necessary, with The Energy Conservatory *Exhaust Fan Flow Meter*.
- 8) Perform worst-case draft test.
- 9) Verify proper operation of all local and whole building ventilation equipment.
- 10) Job completed.


Exhaust Fan Flow Meter

Measurement range from 10 to 124 CFM (1 to 8 Pascals)



Dwelling Ventilation Strategies, Including ASHRAE 62.2

Wisconsin Wx Program Experience with ASHRAE 62.2-2004


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Average Cost of Installation

Exhaust Fan Cost			Controller Cost			Total System Cost		
Mat.	Labor	Total	Mat.	Labor	Total	Mat.	Labor	Total
130.78	242.74	373.52	\$72.60	\$98.93	\$171.52	\$199.92	\$336.95	\$536.88

Data kindly supplied by Wisconsin Weatherization Program, 2004-2005, for a sample of 21 houses for installing ASHRAE 62.2 ventilation, excluding kitchen ventilation. Cost are for


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Frequency of Ventilation Installation


Calculation Method	Ventilation Required	Percentage of Units	Average Vent. Rate
BTLA (0.5 rule)	81 units	47%	65 CFM
62.2	136 units	79%	30 CFM

Data kindly supplied by Wisconsin Weatherization Program, 2004-2005, for a sample of 173 houses.
Post-Wx CFM₅₀: Average = 1819, Median = 1625, Highest = 4118, Lowest = 458.

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Dwelling Ventilation Strategies, Including ASHRAE 62.2


Building Tightness Limit (BTLA) for Acceptable IAQ Based on ASHRAE 62, 119 & 136

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Dwelling Ventilation Strategies, Including ASHRAE 62.2


BTLA Procedure

- BTLA based on ASHRAE 62, 119, and 136.
 - More complex, but more information.
 - Gives limit and *existing conditions* based on input.
 - Probably more accurate.
 - Calculates ventilation CFM requirement.

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Dwelling Ventilation Strategies, Including ASHRAE 62.2

BTLA Procedure

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BTLa Procedure

- For a 1500 ft² house in Indianapolis:

```

1.ELA in2=66
2.ELA in2=124
3. Estim Nat CFM=65
4. Estim Nat ACH=.32
5. Natural CFM/occ=13
6.ELA min in2=77
7. CFM min=75
8. Vent. CFM Needed=21
    
```

ZipTest Pro² software
inputs and outputs

```

a>1200      1>66      All
b>.000000  2>124     Data
c>.86      3>65
d>2000     4>.32
e>16000    5>13
f>16.0     6>75
g>8.0      7>21
h>5        8>21
    
```

9>1393

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BTLa Procedure

- For a 2000 ft² house in Indianapolis:

```

1.ELA in2=77
2.ELA in2=145
3. Estim Nat CFM=75
4. Estim Nat ACH=.28
5. Natural CFM/occ=15
6.ELA min in2=95
7. CFM min=93
8. Vent. CFM Needed=36
    
```

ZipTest Pro² software
inputs and outputs

```

a>1400      1>77      All
b>.65      2>145     Data
c>.86      3>75
d>2000     4>.28
e>16000    5>15
f>16.0     6>93
g>8.0      7>36
h>5        8>36
    
```

9>1734

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