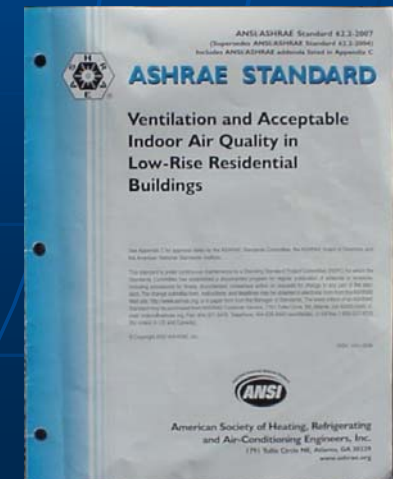




Building Codes, Ventilation Rates, and Certified Performance

Ventilation Track
Comfortech 2007
St Louis, MO
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- National Research & Development Manager, Panasonic Home & Environment Company
- Voting Member, SPC 62.2 and SSPC 62.2
- Vice-Chair, SSPC 62.2
- Past Chair, Home Ventilating Institute (HVI)
- Consultant to ventilation manufacturers, utilities, and agencies on codes, standards, and product development 1983-2007
- Participant in development of ventilation codes nationally since 1984

Building and Ventilation Codes

Ventilation Rates

Certified Performance

Q&A

Ventilation Codes

- IRC-2006
- Washington State VIAQ 1991/2006
- Minnesota Energy Code 1998/2006
- California Title 24 2008



Ventilation Codes

- IRC-2006

- Residential one and two family
- Adopted in many states
- Requires whole house ventilation at 0.35 ACH but can be met with windows
- Requires bath fans only if no operable window
- Requires kitchen ventilation if no operable window

Ventilation Codes

- Washington State Ventilation and Indoor Air Quality Code (VIAQ)
 - Adopted first in 1990
 - Updated to current 2006 version
 - Requires mechanical whole house ventilation at least eight hours a day with 1.5 sones max fan or remote fan or airhandler
 - Requires bath fans and range hoods

Ventilation Codes

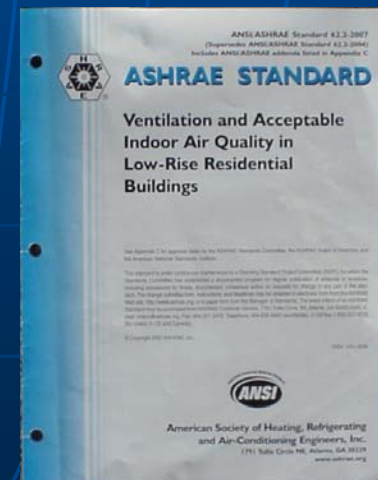
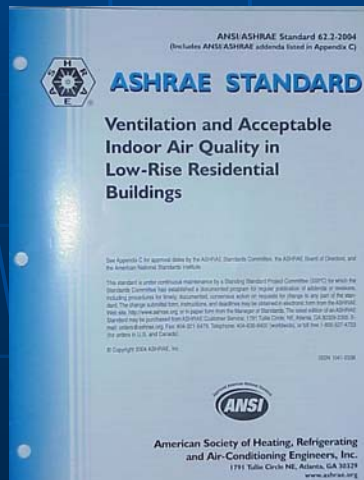
- Minnesota Energy Code
 - First adopted in 1997 and updated several times
 - Requires mechanical ventilation, generally with tempering because of extreme climate
 - Stringent limits on depressurization because of combustion safety
 - Limits primary IAQ fans to 1.5 sones

Ventilation Codes

- California Title 24
 - California Energy Commission is adopting ASHRAE 62.2-2007 as ventilation requirement
 - Effective date 2009 when training materials are in place

Ventilation Standards

- ASHRAE Standard 62-1989
- ASHRAE Standard 62R-1995
- ASHRAE Standard 62.2-2003
- ASHRAE Standard 62.2-2004
- ASHRAE Standard 62.2-2007



Background of ASHRAE 62.2-2007

■ ASHRAE 62-1989

- Based on 15 cfm/person or 0.35 ACH
- Allowed leakiness to provide IAQ ventilation

■ SPC 62

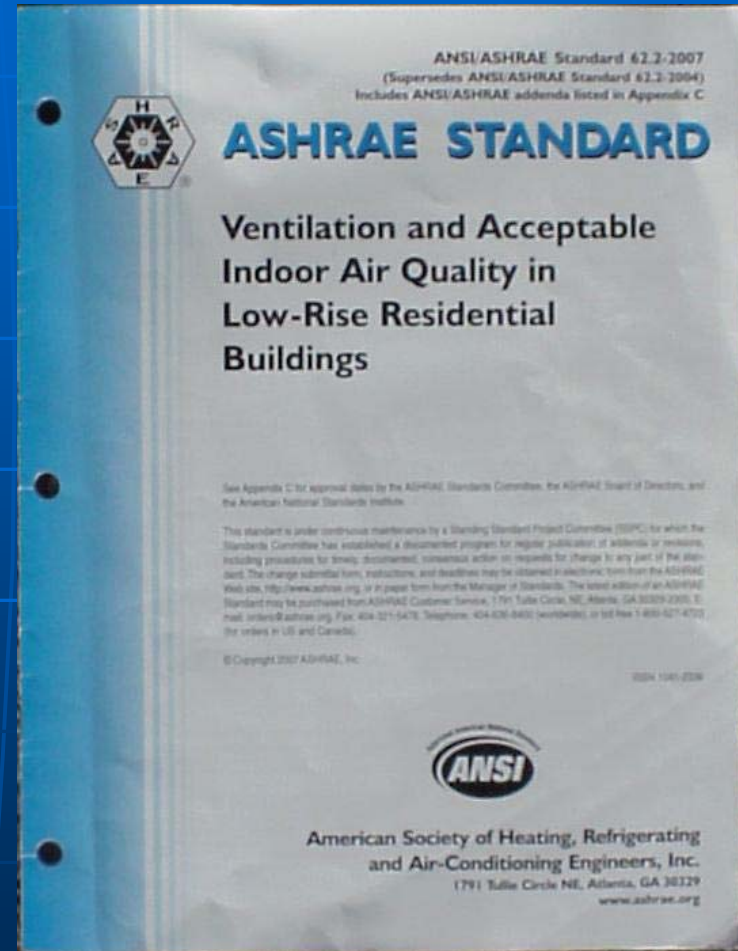
- Formed in 1993 to revise ASHRAE 62-1989
- First Public Review of 62R in 1995
- 13,000+ comments on residential portion
- Residential broken off as new ASHRAE SPC 62.2

Background (cont)

- Standard Project Committee 62.2
 - Formed in 1996 with new members
 - First Public Review in 2000
 - (over 400 comments from 197 commentors)
 - Second Public Review in 2001
 - (414 comments from 134 commentors)
 - Third Public Review (IRC) early 2002
 - (66 comments from 19 commentors)
 - Fourth Public Review (IRC) late 2002
 - (28 comments from 7 commentors)

Background (cont)

- SSPC 62.2
 - Formed in January, 2004 for continuous maintenance of “high profile” standard



Requirements of ANSI/ASHRAE 62.2-2007

- Scope
- Definitions
- Whole Building Ventilation
- Local Exhaust
- Other Requirements
- Air-Moving Equipment
- Venting of Combustion Appliances
- Operations and Maintenance

Scope of ASHRAE 62.2-2007

- Covered in Section 2, Page 2
- “This standard applies to spaces intended for human occupancy within **single-family houses** and **multifamily structures of three stories or fewer** above grade, including manufactured and modular houses. This standard does not apply to transient housing such as hotels, motels, nursing homes, dormitories or jails.”

Scope (cont)

- It does not address high-polluting events such as hobbies, painting, cleaning, or smoking.
- It does not address unvented combustion space heaters such as unvented decorative gas appliances.

Whole Building Ventilation Requirements for General IAQ

- Covered in Section 4, pages 4 & 5
- Applies to all low-rise residential single family and multifamily buildings.
- Exemption to mechanical IAQ ventilation for limited situations.
- Sound rating of 1.0 sones or less is required for exposed whole building ventilation fans.

Whole Building Ventilation Requirements (cont)

- Sizing Table 4.1a is provided based on 7.5 cfm/person plus 1 cfm/100 ft² of conditioned space.
- 62.2-2007 assumes 2 people in the master bedroom like ASHRAE 62-1989.
- Table 4.1a reduces ventilation of larger residences compared to old 0.35 ACH method.

Whole Building Ventilation Requirements (cont) Table 4.1a (cfm)

Number of Bedrooms	0-1	2-3	4-5	6-7	>7
< 1500 ft ²	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 ft ²	105	120	135	150	165

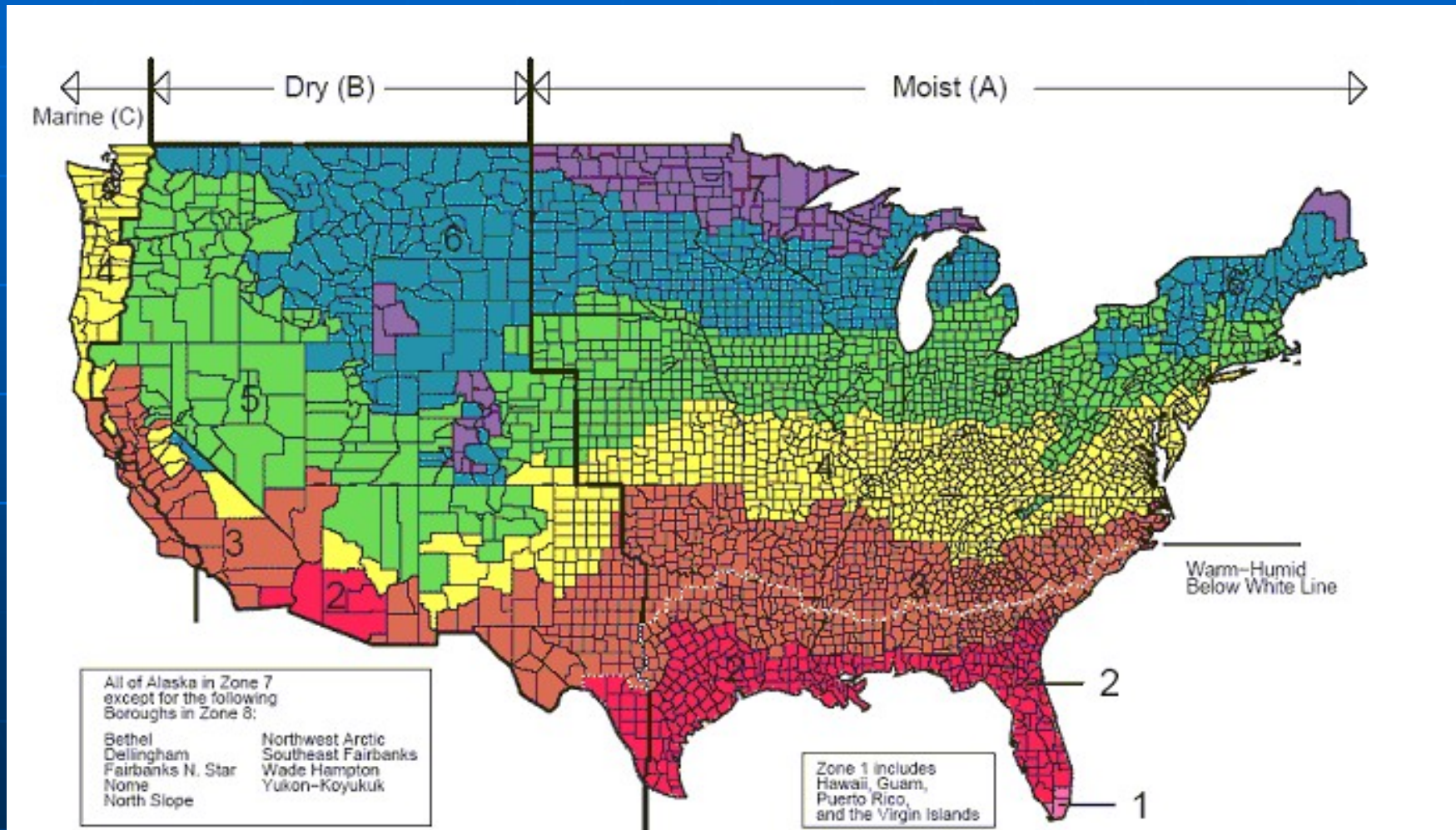
Whole Building Ventilation Requirements (cont)

- This level of ventilation is intended to be provided continuously whenever the building is occupiable.
- This can be supply ventilation, exhaust ventilation, or balanced ventilation.
- This level of ventilation was set including a default credit of 2 cfm/100 ft² for infiltration.

Whole Building Ventilation Requirements (cont)

- Exception to Section 4.1 if one of the following conditions is met:
 - The building is located in Zone 3B or 3C of the 2004 IECC climate map.
 - The building has no central A/C and is in a climate with less than 500 heating °F days.
 - The building is thermally conditioned for human occupancy for less than 876 hours per year.

IECC Climate Map



Whole Building Ventilation Requirements (cont)

- Under these circumstances, it is assumed that windows could be used for natural ventilation, so mechanical whole building ventilation is not required.
- Local exhaust ventilation would still be required for kitchens and baths.



Whole Building Ventilation Requirements (cont)

- Operating time for the whole building ventilation can be reduced if the fan is increased in size and a control is used to control the on-time of the fan.
- This requires increasing the fan size by a factor larger than the on-time factor if the duty cycle is over 3 hours.
- The fan size and on-time can be calculated and evaluated in the design phase.

Whole Building Ventilation Requirements (cont)

- Ventilation effectiveness is a measure of the amount of intermittent ventilation required to maintain the same level of IAQ that would be provided by continuous ventilation.
- It takes into account the lead and lag times of intermittent IAQ ventilation.

Local Exhaust Requirements

- Covered in Section 5 on page 5.
- ASHRAE 62.2-2007 addresses commonly-occurring IAQ sources through local ventilation in baths and kitchens.
- Bathroom ventilation can operate intermittently at a minimum of 50 cfm or continuously at a minimum of 20 cfm, the same as 62-1989.

Local Exhaust Requirements (cont)

- Bath fans must meet the design airflow either through on-site testing or using their certified rated flow at 0.25" water column.
- Bath fans must be rated at 3.0 sones or less or be replaced by a pickup grille for a remote fan.

Local Exhaust Requirements (cont)

- Mechanical kitchen ventilation must be provided by a range hood, a microwave/hood combination, a downdraft fan, a kitchen ceiling or wall fan, or a pickup grille for a remote fan.
- The fan must remove at least 100 cfm if operated intermittently by the occupant or at least five air changes per hour (ACH) if operated continuously.

Local Exhaust Requirements (cont)

- The range hood or microwave/hood combination must be rated at 3.0 sones or less at the minimum flow of 100 cfm.
- Other kitchen exhaust fans must be rated at 3.0 sones or less at their required flow unless over 400 cfm.
- Kitchen fans must meet the design airflow either through on-site testing or using their certified rated flow at 0.25" water column.

Other Requirements in 62-2-2007

- Transfer Air
- Instructions and Labeling
- Combustion Appliances
 - 15 cfm/10 sq ft max
- Garages
- Minimum Filtration
 - MERV 6 filter required if over 10' of supply duct and a thermal conditioning element
- Ventilation Openings

Air-Moving Equipment Requirements

- Ventilation devices must be selected using tested and certified ratings of performance for both airflow and sound in accordance with HVI procedures.
 - HVI Certified Products Directory (www.hvi.org)
 - Continuous fans rated 1.0 sones or less
 - Intermittent fans rated at 3.0 sones or less at the minimum operating airflow of 100 cfm (400 cfm max)

Air-Moving Equipment (cont)

- Airflows must be tested as installed or fans must be sized using the rated flow at 0.25" water column for surface mounted fans and using the maximum duct lengths provided in Table 7.1.
 - Normal name plate data is at 0.1" w.c.

Design Examples For Meeting ANSI/ASHRAE 62.2-2007

- Whole Building IAQ Ventilation Examples
 - Continuous Ventilation Approaches
 - Timer-Based Ventilation Approaches
 - Climate Impacts on System Selection
- Local Exhaust Ventilation Examples
 - Kitchen Ventilation
 - Bathroom Ventilation
 - Other Room Ventilation

Whole Building IAQ Ventilation Examples

- 2,400 ft² 3 bedroom house
 - Can calculate or use Table 4.1a
 - 3 bedrooms assumes 4 occupants
 - 4 occupants x 7.5 cfm/occ + 2400 ft² x 1/100 ft² = **54 cfm** required flow
 - Using Table 4.1a, go across table at 1500-3000 ft² and down from 2-3 bedrooms = **60 cfm** required flow

Whole Building Ventilation Requirements (cont) Table 4.1a (cfm)

Number of Bedrooms	0-1	2-3	4-5	6-7	>7
<1500 ft ²	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 ft ²	105	120	135	150	165

Whole Building IAQ Ventilation Examples (cont)

- 7,000 ft² 4 bedroom house
 - 4 bedrooms assumes 5 occupants
 - 5 occupants x 7.5 cfm/occ + 7,000 ft² x 1/100 ft² = **108 cfm** required flow
 - Using Table 4.1a, go across table at 6001-7500 ft² and down from 4-5 bedrooms = **120 cfm** required flow

Whole Building Ventilation Requirements (cont) Table 4.1a (cfm)

Number of Bedrooms	0-1	2-3	4-5	6-7	>7
<1500 ft ²	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 ft ²	105	120	135	150	165

Whole Building IAQ Ventilation Examples (cont)

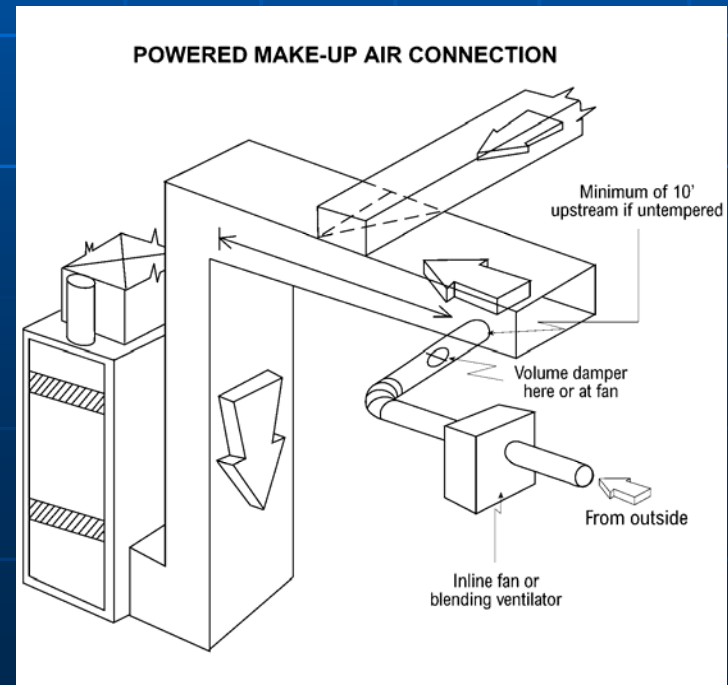
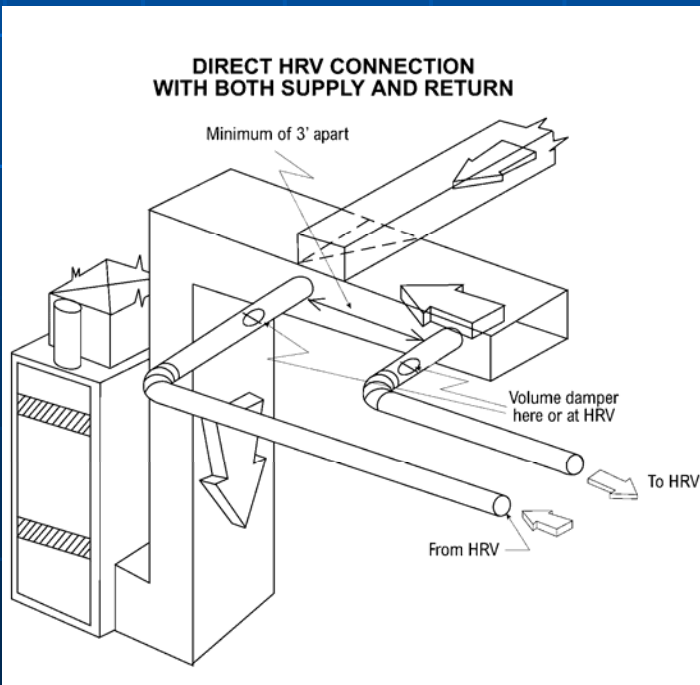
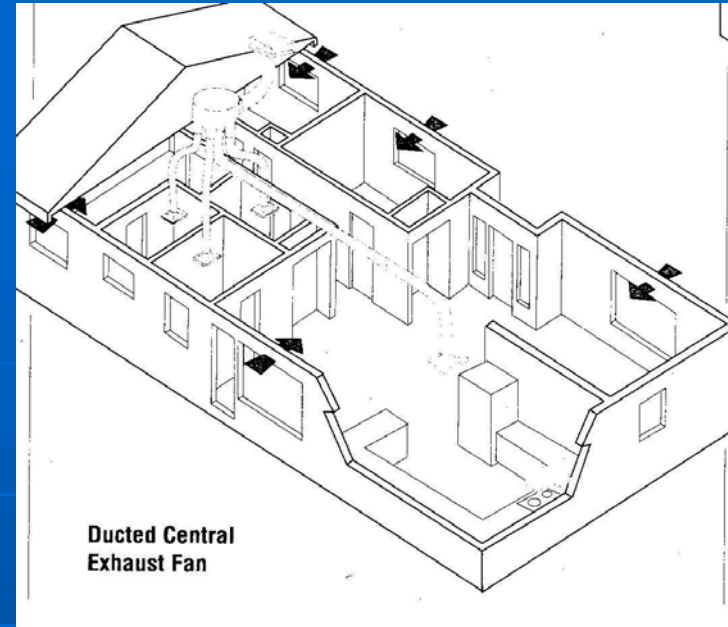
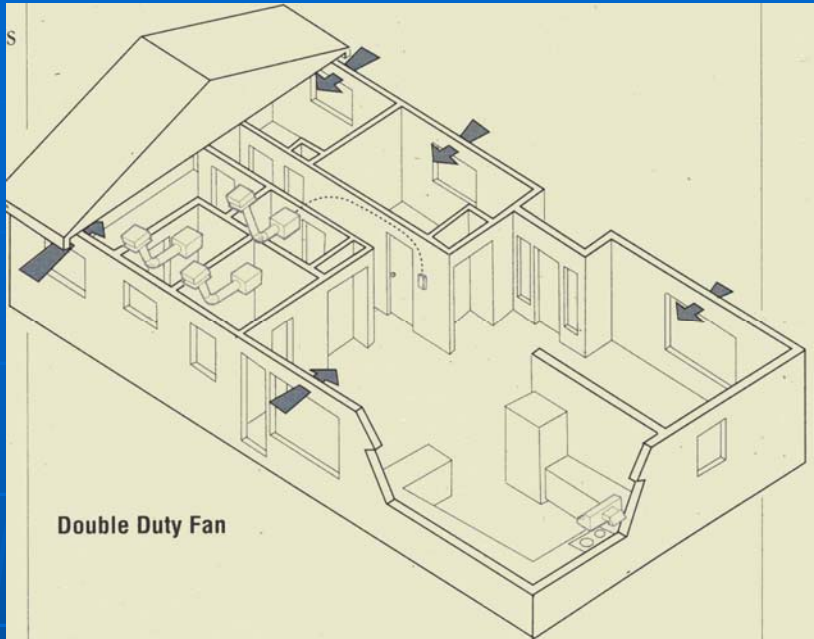
- 1,100 ft² two bedroom apartment
 - 2 bedrooms assumes 3 occupants
 - 3 occupants x 7.5 cfm/occ + 1,100 ft² x 1/100 ft² = **34 cfm** required flow
 - Using Table 4.1a, go across table at <1500 ft² and down from 2-3 bedrooms = **45 cfm** required flow

Whole Building Ventilation Requirements (cont) Table 4.1a (cfm)

Number of Bedrooms	0-1	2-3	4-5	6-7	>7
<1500 ft ²	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 ft ²	105	120	135	150	165

Continuous Ventilation Approaches

- Section 4.2 allows supply, exhaust, or balanced flow to ensure that the above amount of outdoor air is introduced into the house or apartment
- No specific requirement for distribution to every room, but some concern



Performance Testing and Certification

- Home Ventilating Institute
 - Ventilation Industry Trade Association
 - 85%+ of North American products
 - Airflow and sound testing
 - Certification program
 - Certified Product Directory
 - www.hvi.org
 - 1-847-526-2010

Testing and Certification at HVI

- Testing done at third party labs:
 - Energy Systems Lab (ESL) at Texas A&M University in College Station, TX
 - All fan products down to less than 0.3 sones
 - AMCA Lab in Arlington Heights, IL
 - All fan products down to 1.5 sones
 - Bodycote Lab in Mississauga, Ontario
 - HRV and ERV products

Testing and Certification (cont.)

- Fans are mounted on a stand for airflow testing
- A calibrated airflow test chamber is used

Fan mounted for airflow testing



Fan for Figure 12 air tests

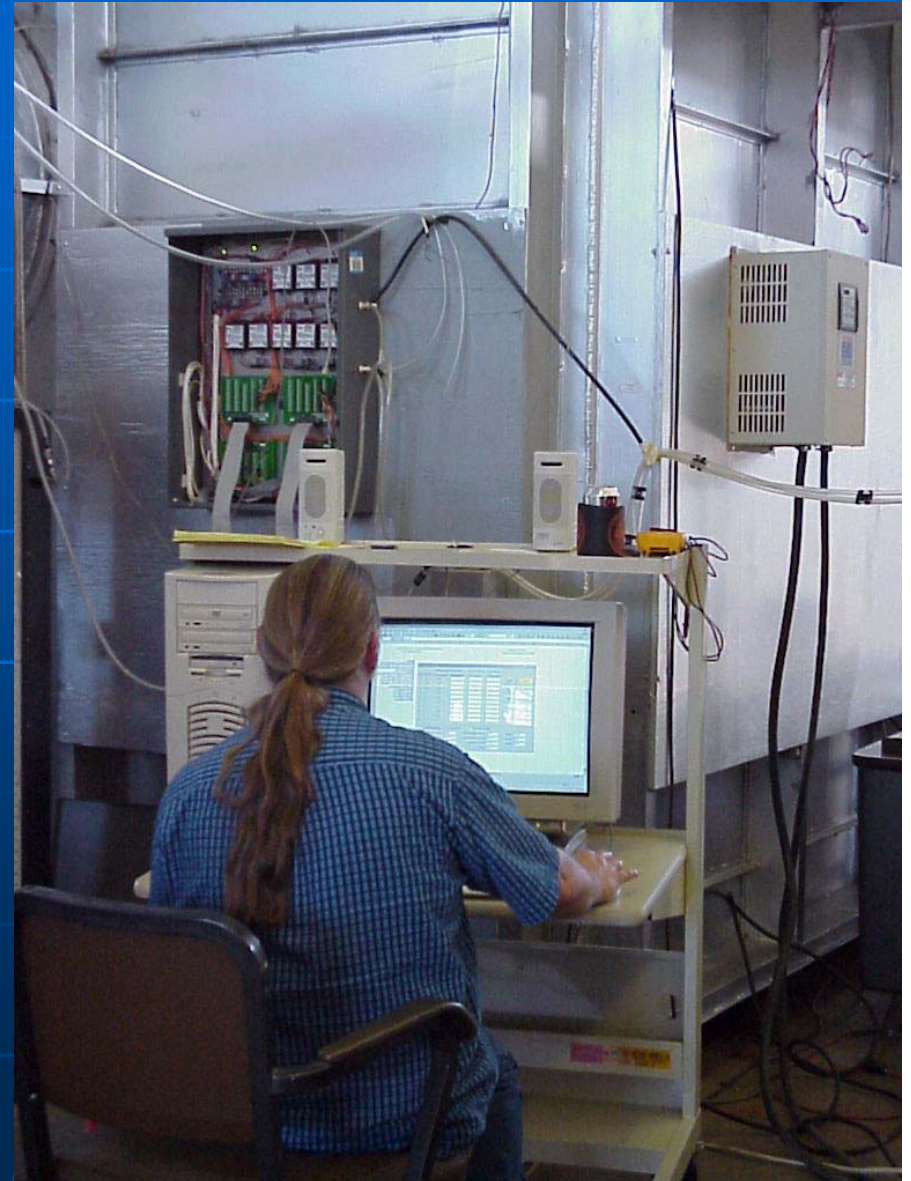


Tachometer on bath fan

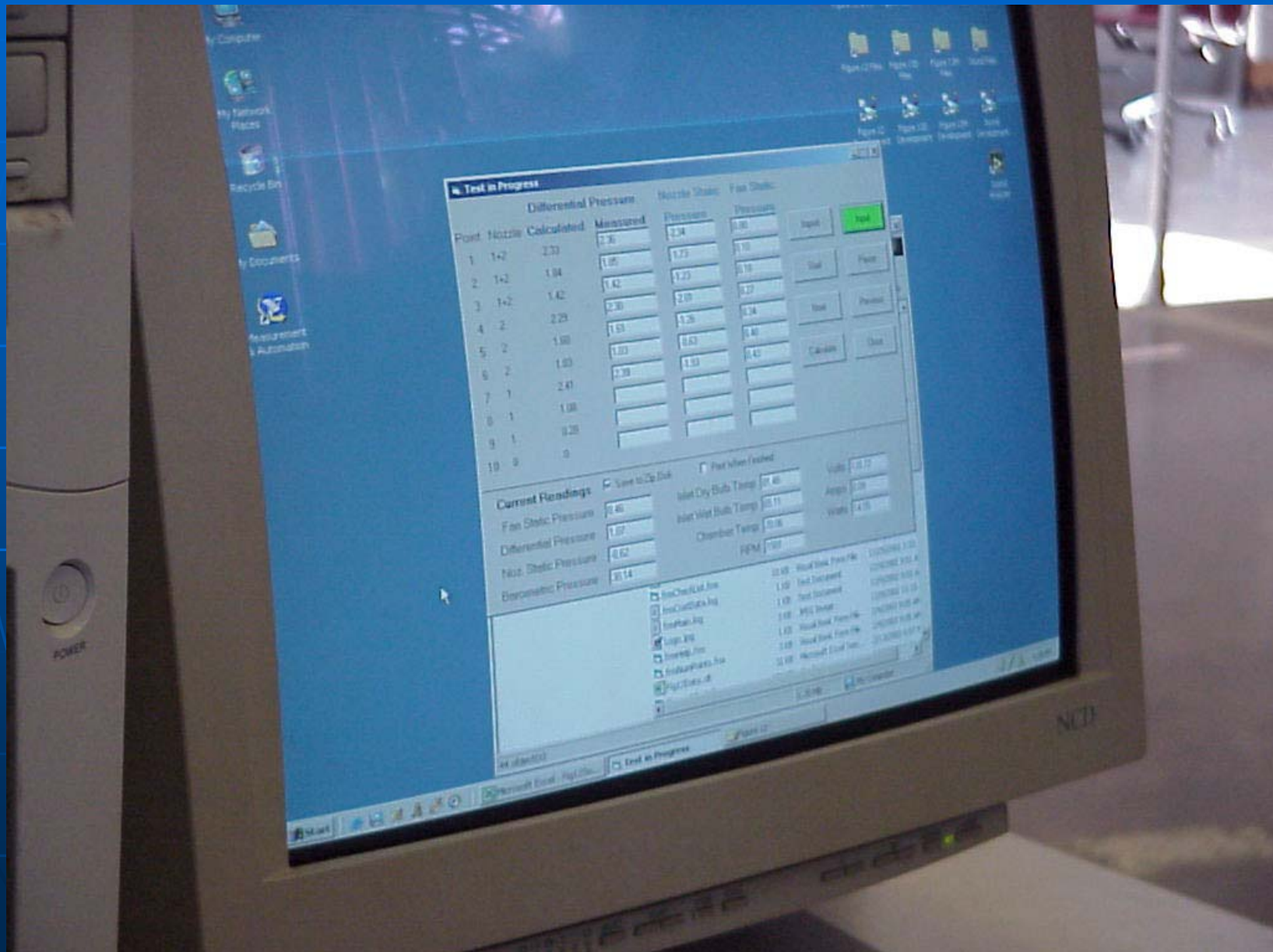


Testing and Certification (cont.)

- Fan airflow is monitored automatically by the ESL technician
- Measurements are taken at a variety of pressures from 0" w.c. to shutoff of fan at 0.4-0.8" w.c.



Data on screen



Testing and Certification (cont.)

- Sound testing is done in a certified sound chamber
- A rotating microphone is used to measure sound power at 24 frequencies
- Sound room is concrete double-wall, isolated from the rest of lab, and "floats" on rubber cushions or sand

Boom mike for sound test



Testing and Certification (cont.)

- Sound measurements are collected by computer software
- Measurement of background noise and a standard Reference Sound Source are taken
- Computer compares sound pressure level at 24 frequencies and calculates linear sound level in sones

Fan mounted
on stand for
sound test



Testing and Certification (cont.)

- Final output does weighted average of some levels at all 24 frequencies
- This determines final some rating



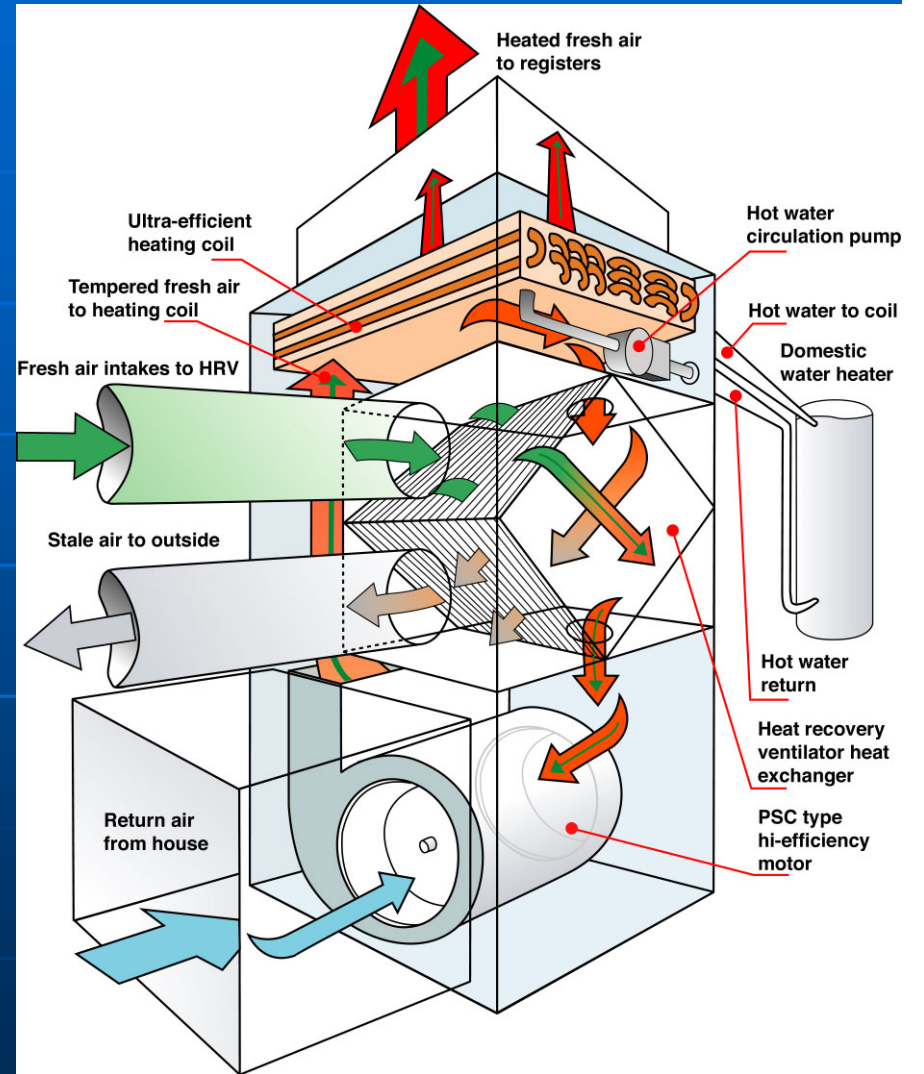
Testing and Certification (cont.)

- The final airflow and sound ratings are submitted by the manufacturer for certification by HVI
- HVI publishes certified results on HVI web site (www.hvi.org)
- HVI Certified Products Directory is updated online monthly

HRV/ERV Testing and Certification

Energy recovery, moisture transfer, cross-leakage, fan power, fan flow in 4 legs, etc
Measured at -13° , 32° , and 95° F





Why use certified products?

- Certified performance from HVI is the best way to ensure expected performance in the field.
- US and Canadian building codes **require** HVI Certified Performance ratings when using prescriptive compliance methods to avoid field testing.
- Data on about 1500 products is available at www.hvi.org

Questions? Don Stevens

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