VentCalc™

Ventilation Report Summary

The attached ventilation worksheet is constructed to show the interrelationship among the several ventilation requirements in residential design. Although each requirement has its unique definition, generally, all can be satisfied with a proper analysis of whole house air leak rates or airflows. Modern construction is plagued more by excess air leakage wasting energy and comfort than by inadequate ventilation creating IAQ or safety issues. Leaky house frequently have disproportionate amounts of "fresh air" coming from garage and attic spaces. Neither is healthy.

Combustion Space Analysis is written to help define adequate airflow particularly in light of the vaguely defined *Unusually Tight Construction* issue. In most homes, basements are part of the conditioned space. Given the connectivity of most combustion zones to the whole house, whole house volume is more than adequate to support natural draft combustion equipment. Basements, even with door closed, are well connected to the living area above because of frame leakage, plumbing wall bypass, flue penetrations, *and by heat system supply registers*. Each six inch supply duct delivers approximately 100 cfm to the basement from the returns placed in the living area above (100cfm, 6000cfh, supports 240,000 BtuHr Input). To analyze an open basement as an isolated, sealed furnace room is incorrect. Requiring added make-up air is normally not justified.

Potential Backdraft Analysis is based on the typical backdraft chart. Measured air leak rates at CFM50 and Worst Case Exhaust (wc) predict Depressurization as a mathematical relationship. While sealed combustion in all living spaces is preferred, natural draft equipment can be safely installed and operated with common sense observations. Whole house (blower door) testing or the simpler pressure difference (pd) test can predict potential backdrafting. Combustion zone, pressure difference testing to the outside for the servicing or installation of *any* natural draft combustion appliance defines backdraft potential. This test is part of the Ohio Weatherization standards and is a much needed addition to our Code language. Backdraft is the most critical of the three ventilation issues. No natural draft appliance should be serviced or installed without a worst-case exhaust evaluation.

House Ventilation Recommendations is the most illusive of the three issues. In the absence of specific code language, the ASHRAE 0.35 ACH natural whole house leak rate is most often referenced. Even with the separate definition of the previous two vent issues, adequate house ventilation is difficult to define. The issue is clouded by the confusion of what is to be ventilated, the house or the occupants.

Consider these two examples:

Living Unit	Duplex on slab	Ranch on basement
Occupants (typical)	2	2
Conditioned Square Feet	1480	6280
Conditioned Cubic Feet	13320	82974
Measured Leakage @CFM50	1450	9850
ACH natural	0.35	0.43
CFM natural	78	592

Which is correctly ventilated? Both units are relatively tight, are at or near the ASHRAE 0.35 standard, but differ by a factor of eight in CFM of air leakage! These are actual tested homes. The ranch has major comfort complaints that require extensive diagnostics and expensive remediation.

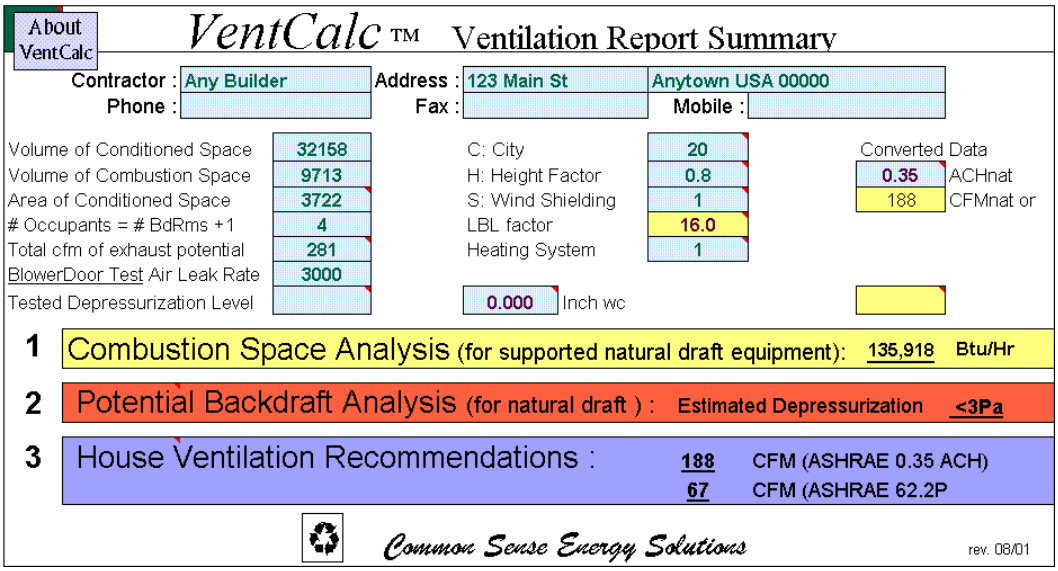
The second ASHRAE ventilation recommendation, 15 cfm/ person, benchmarks the correct factor, *occupants*. To assure whole house IAQ, this recommendation is restated as 15 cfm/ person with a minimum of 75 cfm; however, in extreme circumstances, this ventilation might be insufficient.

An effective ventilation guideline could be stated as 15 cfm/person, minimum 75 cfm, coupled with a controlled auxiliary ventilation device to be used as needed.

This vent device could be a simple exhaust fan. A 75 cfm exhaust bath fan induces a similar cfm *in* through normal leak points. This is adequate in most instances to compensate for temporary indoor odor, moisture, or stale air problems. A single fan can also accommodate seasonal vent requirements. Houses tend to over ventilate in the winter and under ventilate in the spring and fall.

It is important to install at least one quiet, high efficient exhaust fan (.5 sone and <.5 watt/cfm) that can be used as needed. Most bath fans are used minimally because of excessive noise and poor performance. More complicated vent systems can include additional exhaust fans, timer, humidistat, intake fan and heat recovery capabilities; however, these systems are seldom needed.

Given whole house volume and normal leak rates (0.30 - 0.50 ACH nat), Combustion Air, Potential Backdraft, and House Ventilation issues can be easily defined and planned. Given tighter construction (< 0.30 ACH nat), several design alternatives accommodate possible ventilation shortcomings. *VentCalc*™ helps define these issues and suggests possible remediation.



About VentCalc

VentCalc ™ Ventilation Report Summary

Contractor : Any Builder | Address : 123 Main St | Anytown USA 00000
Phone : | Fax : | Mobile :

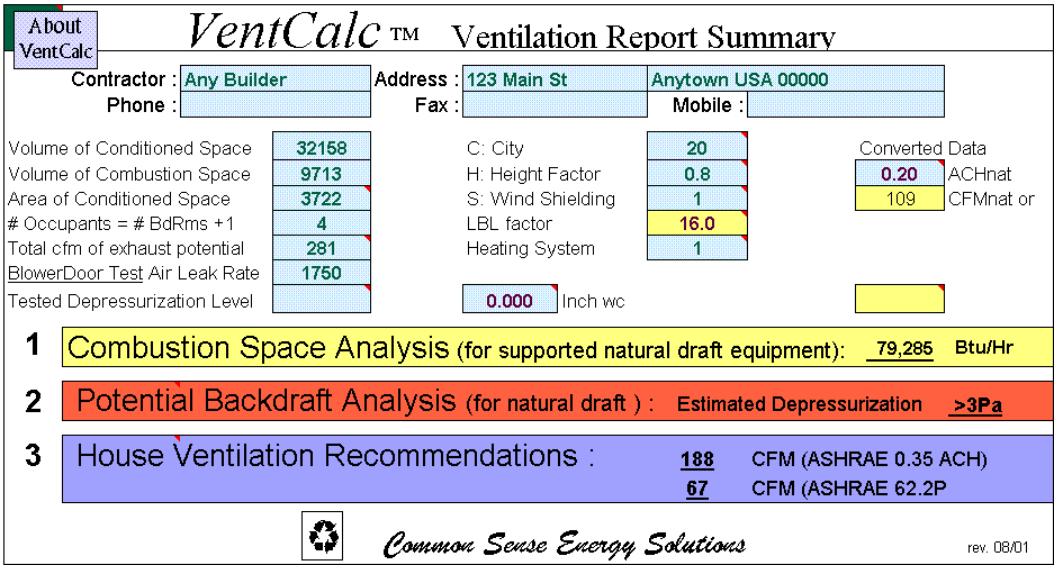
Volume of Conditioned Space	32158	C: City	20	Converted Data	
Volume of Combustion Space	9713	H: Height Factor	0.8	0.35	ACHnat
Area of Conditioned Space	3722	S: Wind Shielding	1	188	CFMnat or
# Occupants = # BdRms +1	4	LBL factor	16.0		
Total cfm of exhaust potential	281	Heating System	1		
BlowerDoor Test Air Leak Rate	3000				
Tested Depressurization Level		0.000 Inch wc			

1 Combustion Space Analysis (for supported natural draft equipment): 135,918 Btu/Hr

2 Potential Backdraft Analysis (for natural draft) : Estimated Depressurization <3Pa

3 House Ventilation Recommendations : 188 CFM (ASHRAE 0.35 ACH)
67 CFM (ASHRAE 62.2P

Common Sense Energy Solutions rev. 08/01



About VentCalc

VentCalc ™ Ventilation Report Summary

Contractor : Any Builder | Address : 123 Main St | Anytown USA 00000
Phone : | Fax : | Mobile :

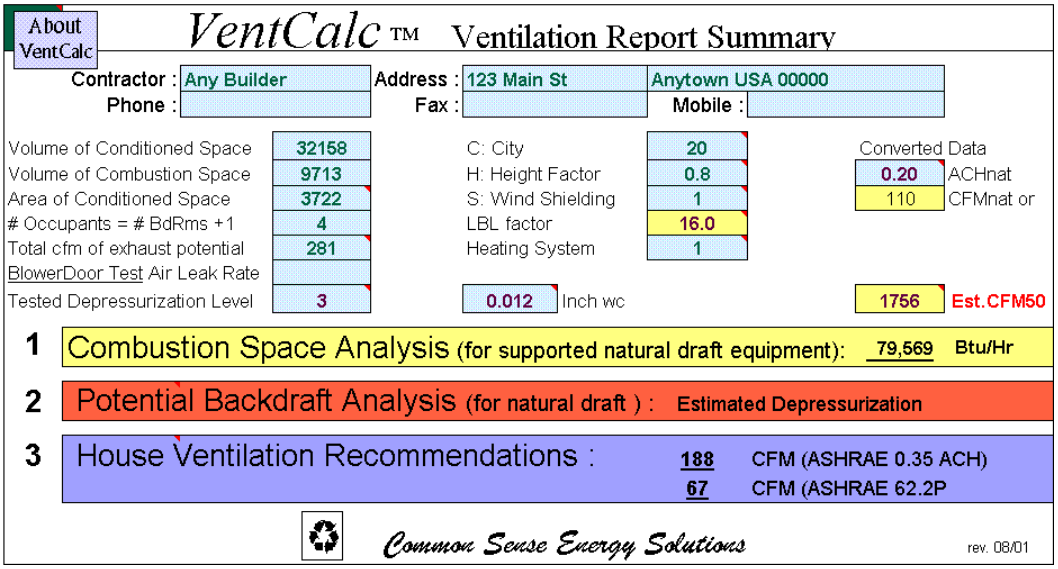
Volume of Conditioned Space	32158	C: City	20	Converted Data	
Volume of Combustion Space	9713	H: Height Factor	0.8	0.20	ACHnat
Area of Conditioned Space	3722	S: Wind Shielding	1	109	CFMnat or
# Occupants = # BdRms +1	4	LBL factor	16.0		
Total cfm of exhaust potential	281	Heating System	1		
BlowerDoor Test Air Leak Rate	1750				
Tested Depressurization Level		0.000 Inch wc			

1 Combustion Space Analysis (for supported natural draft equipment): 79,285 Btu/Hr

2 Potential Backdraft Analysis (for natural draft) : Estimated Depressurization >3Pa

3 House Ventilation Recommendations : 188 CFM (ASHRAE 0.35 ACH)
67 CFM (ASHRAE 62.2P

Common Sense Energy Solutions rev. 08/01



About VentCalc

VentCalc ™ Ventilation Report Summary

Contractor : Any Builder | Address : 123 Main St | Anytown USA 00000
Phone : | Fax : | Mobile :

Volume of Conditioned Space	32158	C: City	20	Converted Data	
Volume of Combustion Space	9713	H: Height Factor	0.8	0.20	ACHnat
Area of Conditioned Space	3722	S: Wind Shielding	1	110	CFMnat or
# Occupants = # BdRms +1	4	LBL factor	16.0		
Total cfm of exhaust potential	281	Heating System	1		
BlowerDoor Test Air Leak Rate					
Tested Depressurization Level	3	0.012 Inch wc		1756	Est.CFM50

1 Combustion Space Analysis (for supported natural draft equipment): 79,569 Btu/Hr

2 Potential Backdraft Analysis (for natural draft) : Estimated Depressurization

3 House Ventilation Recommendations : 188 CFM (ASHRAE 0.35 ACH)
67 CFM (ASHRAE 62.2P

Common Sense Energy Solutions rev. 08/01