Anticipating Depressurization Issues Due to Air Tightness and Ventilation Needs

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tools for energy-efficient living

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Learning Objectives

- Understand how ventilation needs based on ASHRAE 62.2 can impact depressurization
- Learn how to use depressurization calculations in order to predict end state conditions
- Recognize appliances that do not operate safely under natural conditions that can not be effectively repaired to operate safely under worst case conditions.

Learning Objectives

- Gain an understanding of how better planning as part of an assessment will result in better work scopes and customer satisfaction as it relates to combustion safety.
- Recognize the value in collecting data from previous work to provide answers to depressurization effects in future work.

Reasons to Plan For Depressurization Issues

- Ensures the Safety of Household Occupants

  Prevent dangerous back drafting of combustion appliances

- Prepares Customer For Issues

  Clear communication about possible drafting issues can make the customer more likely to remedy situation up Front.

- Demonstrates Issues to Program Planners

  Some funding sources will pay for safety issues, so testing and documentation will demonstrate this need.

- Allows Auditor To Make The Best Work Scope

  Understanding issues up front avoids costly callbacks and re-work

What Is Our Starting Point?

- Air Tightness Level
- Building Size and Height
- Occupants
- Mechanical Equipment
- Exhaust Appliances and total CFM of Exhaust Measurements
- CAZ Depressurization Level/Limits

What Is The Predicted End State?

- Air Tightness Levels >>> More Air Tight
- Building Area/Height >>> Same?
- Occupants >>>Same?
- Exhaust Equipment >>> More Installed/Needed for ASHRAE 62.2?
- Mechanical Equipment >>> Sealed Combustion Installed? Orphaned or Standalone Water Heater?
- CAZ WCD >>> More or Less Negative?

Information Needed to Predict Depressurization Issues

Current CFM_{50} Measurement and Reasonable Post CFM_{50} Estimate

Total CFM of Exhaust Pre and Post Retrofit

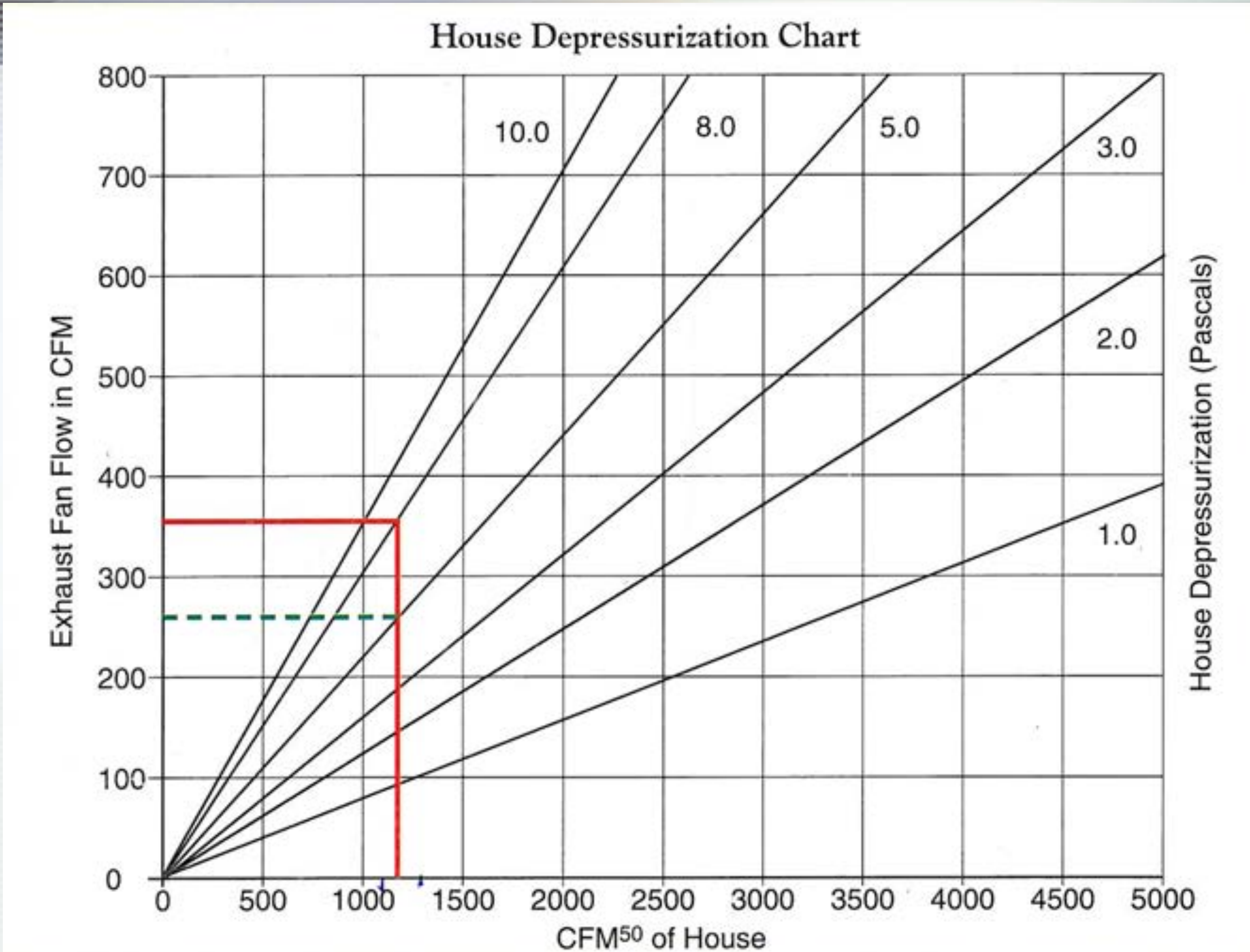
Depressurization Limits for Each Type of Mechanical System Configuration

Predicting End State Air Tightness

- Past Performance Data
  - Average air leakage reduction/contractor skill level
- Building Type/Attic Configuration
  - Ranch Style/Cape Cod/1.5 Story/Split level
  - Peak/Side attics/Multiple attics/Chaseways
- Air Sealing Access
  - Exterior wall tops with hip roof/low pitch
  - Difficult to access band joists.
- Scope of Work
  - Cost restrictions in chasing minor air leaks
  - Side Wall Dense Pack/Combustion Air Added

Predicting End State Exhaust Levels

- Measure Existing Exhaust Appliances:
  - Use Exhaust Fan Flow Meter to Measure Bath Fans
  - Use Depressurization Chart/Calc. for Kitchen Fans and Dryers
- Calculate for Ventilation Needs according to ASHRAE 62.2:
  - Additional Exhaust CFM; point source and whole house
  - Determine exhaust fan scope of work based on calculation/charts
- Add Total Predicted CFM of Exhaust Post Retrofit
  - Dryer, Bath Fans, Kitchen Fans, Etc...


House Depressurization Chart
Exhaust Fan Flow in CFM
House Depressurization (Pascals)
CFM50 of House
10.0
8.0
5.0
3.0
2.0
1.0
0
100
200
300
400
500
600
700
800
500
1000
1500
2000
2500
3000
3500
4000
4500
5000

ASHRAE 62.2

- Whole Building Mechanical Ventilation

$$Q = .01(AREA) + 7.5(OCCUPANTS)$$

Credit taken for natural ventilation in excess of
2 cfm per 100 sq ft (50%)

- Local Exhaust Requirements:

Bathroom: 50 CFM on demand

Kitchen: 100 CFM on demand

ASHRAE 62.2

Floor Area (ft²)	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

[1] *ASHRAE 62.2-2010, p 4*

Determining End State Mechanical Systems/Venting Configurations

Does the Work Scope Involve Repairing or Replacing Any Mechanical Systems?

-Does Existing Chimney need re-lining?

-New Sealed Combustion High Efficiency Furnace/ Boiler?

How Will This Affect The Venting Configuration?

-Will there be an Orphaned/Stand Alone Water Heater?

-Open hearth wood fireplace start up effects on remaining natural draft appliances.

Planning for Depressurization Issues

Determine Acceptable Levels of Depressurization

What type of Mechanical Appliances are Present?

What is the Venting Configuration?

BPI CAZ Depressurization Limits

Orphan natural draft water heater (including outside chimneys)	-2
Natural draft boiler or furnace commonly vented with water heater	-3
Natural draft boiler or furnace with vent damper commonly vented with water heater	-5
Individual natural draft boiler, furnace or domestic hot water heater	-5
Mechanically-assisted draft boiler or furnace commonly vented with water heater	-5
Mechanically-assisted draft boiler or furnace alone, or fan-assisted DHW alone	-15
Chimney-top draft inducer (Exhausto-type or equivalent); High static pressure flame retention head oil burner; Direct-vented appliances/Sealed combustion appliances	-50

Predicting End State CAZ Depressurization

- What is the CAZ Worst Case Depressurization Before Work?
- What is your predicted CFM_{50} After Air Sealing and Insulating?
- What is the Total CFM of Exhaust After Ventilation Needs are Met?
- Do Calculation to Find the ΔP
  - *Flow Exponent—If not doing multi-point Blower Door Test, use .65 in older homes and .7 in newer construction

Depressurization Calculation Exercise

Worst Case Depressurization Calculator

Name: John Doe

Evaluated by: Rebecca Olson

Pressure Limit (Pa)
2

Air Leakage		
CFM50	Exponent	Coefficient
1,375	0.65	108.1

Default exponent for a single point test is 0.65

Worst Case (Pa)	EEF (cfm)	Exhaust Rate (cfm)	Highest Exh. Flow
1.3	128	120	128

Current Conditions

Available Exhaust	Installed Exhaust	New *WC Pres
41	80	2.7

All values in blue must be entered by the user.

All values in black and red are calculated.

Post Construction Conditions

CFM50 reduction = **20%**

Available Exhaust	Installed Exhaust	New *WC Pres
8	80	3.9

CAZ Depressurization

- Factors
  - CFM_{50}
    - Type of leaks
    - Location of leaks
  - CFM of exhaust
    - Dryer
    - Fans
    - Forced Air Distribution

Planning for Depressurization Issues

Do Existing Appliances Draft According to Depressurization Limits?

Will Planned Appliances Draft according to Predicted Depressurization Calculation?

How Close to the Limit is your prediction?

When Do You Decide To Change An Appliance to Allow for more Depressurization?

What Now?

Determining whether Repair or Replacement is Needed for Mechanical Systems to Draft

If Repair or Replacement isn't an Option, Manage Exhaust Use, consider installing a spill monitor.

Determine whether Ventilation can be Downsized and still Comply with 62.2

Planning for Depressurization Issues

Not complex for all buildings

Do not make the same assumptions for all buildings when planning

Use existing data on completed work

Pay attention to critical numbers when testing building performance

Remember the building is a system

Where Do You End

Final Blower Door Test

Revise Calculation based on final CFM_{50}

Installed and Existing Fan Flow Tests

Revise Calculation based on final $CFM_{exhaust}$ totals

Final CAZ Worst Case Depressurization Test

Final Worst Case Draft Test on remaining Natural Draft Appliances

If final WC Draft test fails, test at natural conditions. If passes at natural, install a spill monitor.

Questions?

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