CAZ Door

Open

Closed

FORCED AIR BLOWER

Off

On

Negative number ①

Causes:
- Exhaust appliances

Repairs:
- Eliminate/reduce CFM of exhaust
- Isolate appliances/CAZ from exhaust
- Replace the combustion appliances
- Provide make-up air (not realistic)

More negative from #1 ②

Causes:
- Exhaust appliances in the CAZ or affecting the CAZ

Repairs:
- Eliminate/reduce CFM of exhaust
- Isolate appliances/CAZ from exhaust – interior and exterior connections
- Replace appliances – sealed combustion furnaces, electric or power vented water heaters, etc.
- Pressure relieve CAZ to the house
- Provide make-up air (not realistic)

More negative from #1 ③

Causes:
- Supply duct leakage to the exterior of the structure
- Interior door closure

Repairs:
- Seal supply ducts
- Pressure relieve interior rooms

More positive

Causes:
- Return duct leakage to the exterior of the structure
- Interior door closure

Repairs:
- Seal return ducts
- Pressure relieve interior rooms

More negative from #3 ④

Causes:
- Return duct leakage in the CAZ

Repairs:
- Seal return ducts in the CAZ

More positive

Causes:
- Supply duct leakage in the CAZ

Repairs:
- Seal supply ducts in the CAZ

Baseline (Stack Effect) is present in each quadrant – neg or pos

CAZ (Combustion Appliance Zone) Pressure Test Procedure

Step 1

☐ Make sure combustion appliances are unable to operate during set-up
☐ Remove forced air furnace filter (replace cover)
☐ Close all windows, doors, and other openings to the exterior of the structure
☐ Close fireplace and woodstove dampers
☐ Set up a gauge to read CAZ pressure with reference to (WRT) the outside

Record the baseline CAZ pressure: ☐ Pa (can be done CAZ door both open and closed)

☐ Turn on clothes dryer and all exhaust fans
☐ Use a blower door to simulate fireplace flow as needed (300 cfm or appropriate)
☐ Open supply registers in the house – close the registers in the CAZ
☐ Close all interior doors off the main body except to rooms that contain an exhaust fan

Obtain two CAZ pressure measurements with the forced air blower OFF: One with the CAZ door open and one with the door closed (long term averaging makes this process quicker).

	CAZ Door **Open**	CAZ Door **Closed**
Fan **OFF**	① ☐ Pa	② ☐ Pa

Note: There will be from 1 to 4 pressure measurements taken depending upon whether a blower or CAZ door exists.

Step 2

☐ Operate the forced air system blower (on the highest speed it can be expected to operate)
☐ Close the doors to rooms with exhaust fans and smoke/pressure test the rooms to determine the appropriate door position (testing is done with the CAZ at your back)
☐ Also, smoke/pressure test the doors to bedrooms that contain return ducts
☐ Reposition the doors as necessary (positive pressure in rooms – door closed, negative pressure in rooms – door open)

Obtain two CAZ pressure measurements with the forced air blower ON: One with the CAZ door open and one with the door closed.

	CAZ Door **Open**	CAZ Door **Closed**
Fan **ON**	③ ☐ Pa	④ ☐ Pa

Note: For diagnostics, subtract the baseline pressure to get the actual level of depressurization due to exhaust fans, ducts, or doors.

The greatest negative pressure measured in any of the four quadrants would be considered “worst case” depressurization conditions for operational testing of combustion appliances.

- Diagnostics can now be performed using the four quadrant measurements to determine potential causes and appropriate repairs.

IMPORTANT:

- Any time you encounter a door you are unsure about positioning (ex: a bathroom in a bedroom or a CAZ with a door in a basement with a door at the top of the stairs), smoke/pressure test the door to determine its position. Complete twice – once with the fan on and once with the fan off.
- This procedure will cover most houses most of the time. Understand the concepts and apply them as needed in more complicated houses.

CAZ Appliance Operational Testing

Determine “Worst Case” conditions using the CAZ testing form. Test appliances under “Worst Case” conditions and **monitor ambient CO during all testing!**

Fire the water heater:

1. Was flow established within 10 seconds? Yes ☐ No ☐
2. Did spillage disappear within 2 minutes? Yes ☐ No ☐
3. Carbon monoxide after 5 minutes: _____ PPM

Fire the furnace: (leave the water heater operating if common vented or shares combustion air)

4. Was flow established within 10 seconds? Yes ☐ No ☐ N/A ☐

   Did spillage disappear within 2 minutes in a warm vent? Yes ☐ No ☐ N/A ☐
   5 minutes in a cold vent? Yes ☐ No ☐ N/A ☐

5. Recheck the water heater with the furnace operating. Was there spillage? Yes ☐ No ☐
6. Carbon monoxide level after 5 minutes: _____ PPM
   Further combustion analysis for Oxygen: _____ %
   Stack temperature: _____ °F
   Steady state efficiency: _____ %
7. Supply temperature: _____ °F
   Return temperature: _____ °F
   Temperature rise: _____ °F
8. Did the temperature rise within the manufacturer’s specifications? Yes ☐ No ☐

When should we be doing CAZ testing?

In Michigan, we do not use the BPI 1200 CAZ testing procedure. Ours is a bit more comprehensive, provides better diagnostics and can be utilized in writing a work order for the building. We are concerned not only with H&S (combustion) but also IAQ, Comfort, Building Durability and Efficiency.

Michigan:

- CAZ pressure diagnostics is intended to be performed on all homes
    - There will be the occasional home where it doesn't matter - an exception might be an all-electric home without forced air
- Fireplaces and solid fuel
    - CAZ depressurization testing is intended to be done to evaluate the level of depressurization that could be detrimental to fireplace or solid fuel appliance operation
    - Investigate CAZ depressurization levels that exceed -3pa
- Even if there are no combustion H&S concerns (no interior air being used for combustion), there is value in knowing if there are blower driven pressure imbalances in the building due to duct leaks or door closure
- The auditor and QCI are the point persons responsible for the diagnostics and making sure that all pressure imbalances are reduced to just exhaust fans and that combustion appliances have passed operational testing
- Currently, most shell contractors are not performing daily testing after completion of work on homes with atmospherically vented appliances – this should be a consideration as we don't want to leave homes in a potentially dangerous condition for even one day.

Operational testing of combustion appliances:

- Sealed combustion (no interior air used for combustion)
    - Spillage testing is unnecessary
    - CO if accessible
- Mid and high efficiency furnaces, power-vented water heaters (interior air being used for combustion)
    - Spillage testing as necessary (mid efficiency furnace common vented with atmospheric water heater)
    - CO if accessible
    - When CAZ pressures are more negative than 5 pascals, combustion analysis should be performed to make sure that the combustion process is not affected by the negative pressure
- Atmospherically vented appliances with draft hoods
    - Spillage
    - CO

For clarity, if interior air is being used for combustion, just because something is power vented or draft induced doesn't mean that combustion process will not be affected by interior negative pressure. It is not uncommon for small tight houses to be -8 pa or more negative due to the operation of exhaust fans. If the oxygen number on an 80% furnace, for example, drops with the exhaust fans operating, then you need to make a call on whether you can leave that appliance getting its combustion air from the interior.