Ambient Air Monitoring for CO

The DOE SWS require monitoring of CO during combustion testing to ensure that CO in the combustion appliance zone (CAZ) doesn't exceed 35 ppm as measured. If ambient CO levels in the combustion zone exceed 35 ppm, stop testing for your own safety. Ventilate the CAZ thoroughly before resuming combustion testing. Investigate indoor CO levels, greater than outdoor ambient levels, to determine their cause.

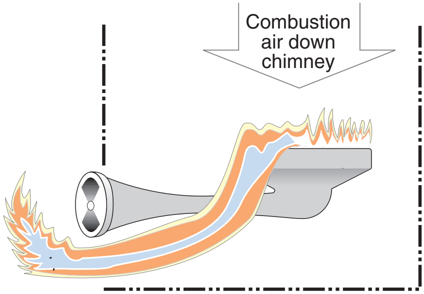
8.2.4 Worst-Case CAZ Depressurization Testing

CAZ depressurization is the leading cause of backdrafting and flame roll-out in furnaces and water heaters that vent into natu-rally drafting chimneys and venting systems.

Worst-case vent testing uses the home's exhaust fans, air handler, and chimneys to create worst-case depressurization in the combustion-appliance zone (CAZ). The CAZ is an area contain-ing one or more combustion appliances. During this worst-case testing, you can measure the CAZ pressure difference with ref-erence (WRT) to outdoors and test for spillage.

Worst-case conditions do occur, and venting systems must exhaust combustion byproducts even under these extreme conditions. Worst-case vent testing exposes whether or not the venting system exhausts the combustion gases when the combustion-zone pressure is as negative as you can make it. A digital manometer is the best tool for accurate and reliable readings of both combustion-zone depressurization and chimney draft.

Flame roll-out: A serious fire hazard can occur when the chimney is blocked, when the combustion zone is depressurized, or during extremely cold weather.



Take all necessary steps to reduce CAZ depressurization and minimize combustion spillage, based on your tests.

Worst-Case CAZ Depressurization Test

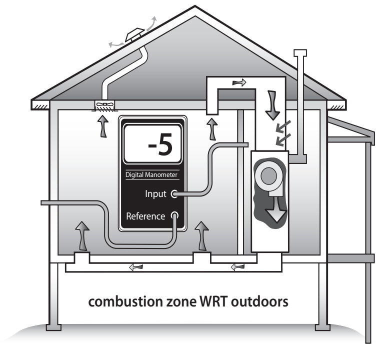
Follow the steps below to find the worst-case depressurization level in the combustion appliance zone (CAZ).

1. Close all exterior doors, windows, and fireplace damper(s). Open all interior doors, including closet doors.
2. Remove furnace filter if it's dirty. Leave the dirty filter out for the test or replace it with a new filter. Be sure the filter slot is covered for the test.
3. Record the baseline pressure of the CAZ with reference to outdoors.
4. Turn on the clothes dryer and exhaust fans. (Clean clothes dryer filter trap)
5. Open doors to negative zones (rooms with exhaust fans), and close doors to positive zones (bedrooms without returns). Use smoke or a manometer to test room pressures if necessary.
6. Open and close the CAZ door. Record the most negative pressure and note CAZ door position.

7. Turn on the furnace air handler. Leave it on if the CAZ pressure goes more negative. If it goes more positive, turn off the air handler and proceed to number 8.

8. Open and close the CAZ door. Record the most negative pressure, and note CAZ door position.

Worst-case depressurization: Worst-case depressurization tests identify problems that weaken draft and restrict combustion air. The testing described here is intended to reveal the cause of the CAZ depressurization and spillage.



9. Calculate the net difference between the worst depressurization found from either #6 or #8 and the baseline pressure from #3. This is the worst-case depressurization.

10. Specify improvement if combustion appliances fail spillage tests.

Analyzing CAZ Depressurization

Analyze the negative and positive pressures you measure in the CAZ to find workable solutions, using the troubleshooting table below.

CAZ Door Closed

Furnace Blower Off

Negative CAZ Pressure

Causes

- Stack effect
- Exhaust appliances in the CAZ or affecting the CAZ

Solutions

- Eliminate or reduce CFM of exhaust
- Isolate CAZ from the exhaust inside the building

Furnace Blower On

By: Tom Andrews

INCAA Training Center,

Negative CAZ Pressure

Causes:

- Stack effect
- Return duct leakage in the CAZ

Solutions

- Seal return ducts in the CAZ

Positive CAZ Pressure

Causes

CAZ Door Open

Furnace Blower Off

Negative CAZ Pressure

Causes

- Stack effect
- Exhaust appliances

Solutions

- Eliminate or reduce CFM of exhaust

Furnace Blower On

Negative CAZ Pressure

Causes

- Stack effect
- Supply duct leakage to outdoors
- Interior door closure

Solutions

- Seal supply ducts
- Pressure relieve interior rooms

Positive CAZ Pressure

Causes

- Return duct leakage to out-

Spillage and CO Testing

Next, verify that the appliance venting systems don't spill or produce excessive CO at worst-case depressurization. Test each appliance in turn for spillage and CO as described below.

1. Check for flue-gas flow in the venting system. Feel the vent connector for heat. The vent connector should start warming within 5 seconds if it establishes flue-gas flow. If the vent connector remains cold, stop the test and investigate.
2. Detect spillage at the draft diverter of each combustion appliance in one of these ways.
   a. Smoke from a smoke generator is repelled by spillage at the draft diverter.
   b. A mirror fogs at the draft diverter
3. If spillage in one or more appliances continues at worst-case depressurization for 2 minutes or more, take action to correct the problem.
4. Measure CO in the undiluted flue gases of each **space heater or water heater** after 2 minutes of operation at worst-case depressurization. If CO in undiluted flue gases is more than **200 ppm air-free** measurement, take action to reduce CO level.
5. Measure CO in the undiluted flue gases of each **furnace or boiler** after 2 minutes of operation at worst-case depressurization. If CO in undiluted flue gases is more than **400 ppm air-free** measurement, take action to reduce CO level.
6. Measure draft after 5 minutes.

Spillage and draft: Spillage and draft are two indications of whether the combustion gases are exiting the building as they should. In this guide, we focus on spillage because it's spillage we're trying to avoid, and we can detect it easily.