

AK Combustion Safety Test Form (CSTF) Technical Support Document

This document is intended to support in detail the Combustion Safety Test Form. The Combustion Safety Test Form is a tool to document the condition of two (2) appliances and their performance. Each combustion appliance in homes that are weatherized or repaired must be documented. The pre- and post- tests are documented on the Combustion Safety Test Form. The CSTF is filled out by the Energy Auditor and the Quality Control Inspector respectively.

The Combustion Safety Test Form must be filled out in detail for each completed project. You must document in the comments section of the Combustion Safety Test Form any special circumstances or health and safety related concerns that might help someone understand the condition of the home (pre- and post-), as well as the concerns expressed by the occupants, or the agency concerns for the occupants safety at the time testing was performed.

The testing procedure outlined in this document is intended to be the minimum tests needed to understand the condition and performance of an appliance. It is recommended that more in-depth testing be performed where multiple appliances share a chimney, or where other indications of potential problems exist.

Line 1

Always start testing safely.

Start all testing tools, Combustion Analyzer, Combustibles Gas Detector, 4 Gas Monitor outdoors.

Confirm readings outside, away from combustion and roadways.

- Use your 4 gas monitor to confirm you are working in a safe environment.
- Monitor ambient Carbon Monoxide before testing and during all testing.

Walk into the building and monitor an indoor ambient air CO reading and a combustible gas %LEL reading on each floor.

Use the appropriate action level table to assess the safe environment.

Safe Environment

If any Ambient CO is found,

Reference the **CO Action Levels (& LEL)** table (on page 2 of form) for guidance.

Line 2 Natural Gas and LP Piping Testing

With your Combustible Gas Detector (CGD) check for leaks at the tank/meter, gas lines, pipe fittings, supply lines connecting to the appliance, appliance gas valve and regulator.

Document if leaks were found YES / NO and follow appropriate action level:

- 2a. When the CGD indicates that combustible gas exists in the ambient atmosphere (at any level below 10% of LEL) and a gas leak cannot be confirmed with the use of leak detection solution, the auditor shall inform the homeowner/occupants and advise the homeowner/occupant to notify the gas company and/or a qualified professional.
- 2b. Detected leaks confirmed with fluid?

Action Level

Where the auditor identifies deficiencies in gas piping materials, connections, components, or supports, the deficiencies shall be noted in project documentation along with a recommendation that the homeowner/occupant contact a qualified professional to inspect the system.

Line 3a Identification of Appliances

- 3a. What kind of appliances are being tested?

Line 4 Visual Inspection of CAZ for Unsafe Conditions

Is there anything in the CAZ that could be considered a health and safety problem? Indoor Air Quality (IAQ), electrical discrepancies, fire hazards, combustibles, or potential testing problems that should be documented. If yes, **follow the action level table required.**

- 4a. The CAZ must be free of flammable products such as liquid and pressurized vapors
- 4b. The CAZ must be free of combustibles such as rags and paper in the immediate area of the appliance.
- 4c. Water Heaters in garages must be 18" above the floor or Flame Vapor Ignition Resistant listed.
 - Residential water heaters manufactured after 2003 are "FVIR" (Flammable Vapor Ignition Resistant) compliant, this means that the combustion chamber is now sealed. In order to light the water heater, you must use the pilot mechanism and you can no longer use a match.
 - Effective July 1, 2003, all water heater manufacturers are required to build their 30, 40, & 50 gallon atmospheric vent water heaters to new government standards. The [American National Standards Institution \(ANSI\)](#) has established these new standards to prevent accidental or unintended ignition of flammable vapors, such as those emitted by gasoline.
- 4d. The combustion appliance vent must have appropriate clearance to combustibles.
Use the table to assess clearance to combustibles and document.

Actions Required/Guidance

- 1. Unsafe conditions may be alleviated by removal of obstructions and materials and advise the occupant is what has been done.
- 2. Unsafe conditions that cannot be immediately fixed, the occupant shall be advised appliance should not be used until the unsafe condition is fixed.

3. Unsafe condition WATER HEATER IN GARAGE is not at least 18" above the floor and is not FVIR listed. Advise occupant of the unsafe condition.
4. Unsafe conditions shall be noted in project documentation.

Line 5-5e Setting up CAZ in worst case

The intent of setting up the CAZ in worst case is to set it up with the greatest negative pressure. This may require opening and closing doors and turning on and off fans to attain this pressure.

The intent of documenting lines 6a-6i is to show in what condition the greatest negative pressure was achieved. With that information if spillage occurs use table:

ANNEX D (BPI 1200) ACTION LEVELS FOR SPILLAGE AND CO IN COMBUSTION APPLIANCES.

This table states the 3 conditions that spillage occurs, read the table carefully and be aware of spillage and excessive CO requirement.

Procedure for setting up the CAZ in Worst Case.

1. Place all combustion appliances located within the CAZ in their standby mode and prepare for operation.
2. Turn off any mechanical ventilation and forced air cooling or heating system blowers.
3. Fires in woodstoves and/or fireplaces shall be fully extinguished, with no hot coals or embers, prior to performing a depressurization test. Close fireplace dampers and any fireplace doors.
4. Close all building exterior doors and windows. **Close all CAZ doors.** Close the interior doors of all rooms except for rooms with an exhaust fan and rooms with a central forced air system return. Outdoor openings for combustion air shall remain open.
5. Using a calibrated manometer or similar pressure measuring device intended for this purpose, measure and record the baseline pressure in the **CAZ with reference to (WRT) outside pa.**
6. Turn on the following exhaust equipment: clothes dryers (check and clean the dryer filter and look for blockage at the external vent damper prior to operation), range hoods, and other exhaust fans. If there are speed controls, operate the exhaust equipment at the highest speed setting. Do not operate a whole house cooling exhaust fan. Measure and record pressure in the **CAZ with reference to (WRT) outside pa.**
7. Turn on central forced air blower. Measure and record pressure in the **CAZ with reference to (WRT) outside pa.**
8. IF the CAZ goes more negative with blower on leave on for the test, if the CAZ goes more positive leave off for the test.
9. Open the CAZ door measure and record pressure in the **CAZ with reference to (WRT) outside pa.**
10. If the changing the CAZ door makes it more negative leave it open for the test, if not leave it closed.
11. Start the spillage test with largest negative pressure in the CAZ with reference to (WRT) outside.

Line 6a-6d CO and Spillage Assessment single vent

CO and Spillage assessments are performed on open combustion natural draft appliances that have a draft hood or barometric damper. Examples are gas or oil fired water heaters, gas or oil fired furnaces and decorative room heaters with a draft hood.

Spillage is assessed at 2 minutes operation (warm vent) in appliances that are in on position when you are there for your energy audit. Spillage is assessed at 5 minutes of operation (cold

vent) on appliances that are not in on position when you are auditing the home. Examples might be a furnace in off position because it is summer or a decorative room heater set to pilot because it is only used on holidays.

If spillage fails it is suggested you take your CO measurement as soon as possible to avoid exposing yourself to excessive combustion gas.

CO is assessed at 5 minutes of burner operation unless the appliance has failed spillage.

CO assessments in combustion appliances are done in the undiluted flue gases.

CO measurements are done AIR FREE. Air FREE is only available on a combustion analyzer that has an oxygen sensor.

Ambient CO is measured at during the test and at the end of the test.

Line 7 CO Assessment multiple appliances common vent

Test appliances in order from lowest BTUh rating to highest.

The appliance with lowest BTUh input rating shall be assessed for spillage and CO measurement in undiluted flue gas conducted in accordance to above instructions.

Upon completion of first appliance test, place next largest appliance in operation, while first appliance is still operating.

Retest first appliance for spillage when second appliance has reached 2 minutes of main burner operation. Test second appliance for spillage immediately thereafter.

Measure CO of the second appliance at 5 minutes of its main burner operation. Continue this operation for each additional appliance.

Actions Required/Guidance for lines 6 and 7

If the any CO Threshold Limits are exceeded, then the Local agency must take steps to eliminate the problem:

- Advise the homeowner/occupant that the appliance should be serviced immediately by a qualified professional.
- The SWS and the AK Field Guide require service to be provided.

Line 8 CO Assessment – Furnace ONLY

Appliances that are not tested for **spillage** but are tested for **CO** would include appliances; power vented, sealed combustion, or direct-vented units, category 3 and category 4 appliances.

Induced draft appliances that are vented in common with natural draft water heaters will be tested for CO and spillage.

- CO is assessed at 5 minutes of burner operation.
- CO assessments in combustion appliances are done in the undiluted flue gases.

- CO measurements are done AIR FREE. Air FREE is only available on a combustion analyzer that has an oxygen sensor.

Ambient CO is measured during the test and at the end of the test

Line 9-9c Natural Gas and LP Oven Testing

9a. Always check in the oven for stored items before starting the oven.

Assess Burner Flame Quality: Yellow flame?

Start the oven at 350 degrees, after 5 minutes turn the oven up to 500 degrees to make sure the oven is on when taking your measurement.

9b. Record the CO as measured after 5 minutes of operation.

Use the **CO Thresholds For Fossil-Fueled Fired Combustion Appliances** table to determine whether the CO level is acceptable. Based upon the result follow the action required using the **CO Action Levels (&LEL)** table.

Oven CO measurements are done in the vent of the oven and are done in CO as measured. This is a different line, window, in the menu on your combustion analyzer.

If the CO Threshold Limit (*per BPI for Oven/Broiler if CO > 225 as measured*) is exceeded,

- The SWS and the AK Field Guide require service to be provided.
- If it is not possible to eliminate the problem, document in the client file the actions taken and confirmation the client was informed of the issue.

Line 10 WoodStove/FirePlace

Inspect appliance and combustion zone where it is located for unsafe installation or possible fire hazards. Safety inspections related to space heaters, fireplaces, and woodstoves must include, but not be limited to, verification of adequate floor protection and code-compliant clearances to walls, and other combustible materials. If the unit is to be left operational, the vent must meet national and/or local codes or the project must be deferred until corrected.

Actions:

- Install a carbon detector in combustion zone
- Hand out to client education document explaining the dangers of carbon monoxide and cautionary measures to assure safe combustion. (AHFC Backdrafting Client Ed Sheet)
- Assure there is a working fire extinguisher in the immediate vicinity. If not install an appropriate one for solid fuel fires.