

Whole House Combustion Safety Field Checklist

JUNE 2012

GSR Call Procedures - If a GSR visit is required, follow the GSR Call Procedures.

Participating contractors may attempt to repair any conditions that caused a Combustion Appliance Safety (CAS) test to fail provided they are properly licensed to do so. If the participating contractor is unable to repair any conditions that caused a CAS test to fail, the participating contractor must call a PG&E Gas Service Representative (GSR) as required by the Whole House Action Guidelines.

If a GSR call is required, contact the GSR immediately (before leaving the customer's home). To contact the GSR and schedule a visit, the participating contractor must call PG&E Central Inspection Program (CIP) Dispatch at 1-800-813-1975 during normal business hours or the PG&E Customer Service Line at 1-800-743-5000 after 5:30 PM or on weekends. The participating contractor must also notify the customer of the need for a GSR visit.

CAS Applicability – CAS testing shall be conducted for all natural gas appliances affecting the living space except appliances that are (a) abandoned (disconnected or capped off) or (b) inaccessible (i.e. locked room, access problem, crawl space is too small, unsafe access). Natural gas appliances on the exterior of the building not within 4' of an operable door or window are exempt from CAS. However, these appliances must be inspected for gas leaks, combustion ventilation air (CVA) requirements, potential fire hazards due to charring of framing members, burner intakes clogged with dust and/or lint, and other hazards. Per Action Guidelines, follow GSR Call Procedures when found.

Appliance Visual Inspection: Refer to the Whole House Action Guidelines.

Check all items under the Existing Conditions and/or Fail Reasons column on the Whole House Action Guidelines. If an item is found, refer to the column headings and take action as indicated. Be sure to read the numbered footnotes, and follow the Gas Service Representative (GSR) Call Procedures.

Appliance Examination – Prior to performing the pre-weatherization Combustion Appliance Safety (CAS) tests on all gas appliances (other than gas log lighters and gas dryers), examine appliance(s) for signs of excessive soot and rust, cracked heat exchanger(s) on heating appliances, forced air furnace (FAF) communication, delayed ignition on start up, continuous flame roll-out after initial start up, flame interference on FAFs when the air handler comes on, and yellow flames greater than 50%. When any of these items are found, follow the GSR Call Procedures. Record all pass or fail results, Carbon Monoxide (CO) readings, and fail codes on the Test Measurements Form. Enter comments on all items that are not normal.

Room Ambient CO Read

- Locate all gas appliances. Turn the thermostat down or off; note the "as found" setting.
- Open all interior doors. Close FAF/AWH (automatic water heater) closet door(s) and fireplace damper.
- Close all exterior doors and windows and turn off all ceiling/circulating fans, evaporative coolers and exhaust fans. **Note: If an interior cooler cover is available it shall be in place.**
- Zero the CO Analyzer outside.
- Room Ambient read is taken as close to the center of the home as possible, at least 10' away from any supply registers or gas appliances, and about 6' above the floor. When an initial reading of 10 ppm or higher is found, aerate house and retest. If second test is 10 ppm or above, continue on with all remaining phases of the test and call for GSR.

Appliance CO Testing Procedure

- **Set home up in "worst case" scenario.** Follow BPI's Worst Case Depressurization protocol to create worst case conditions
 1. Close exterior of the house, open interior
 2. Close fireplace damper and glass doors
 3. Turn off all exhaust fans
 4. Registers
 - a. No requirement on register positioning, recommend placing at HVAC optimal operating conditions
 5. Record baseline of each CAZ WRT (With Reference To) outside
 6. Turn on all exhaust fans
 - a. **Ask Customer to remove clothes from dryer and clean the lint screen prior to testing**
 7. Position interior door(s) to make CAZ and /or Main body more negative
 8. Record pressure of each CAZ WRT outside
 9. Remove air handler filter if dirty
 10. Turn on air handler if exist
 11. Reposition interior doors to make CAZ and /or Main body more negative
 12. Record each CAZ WRT outside
 13. Determine interaction of main body to each CAZ
 14. Record each CAZ WRT outside
 15. Determine interaction of each CAZ to each other
 16. Record each CAZ WRT outside
 17. Calculate WCD (Worst Case Depression)
 18. Set each CAZ to Worst Case to do Spillage, CO and Draft testing

- **Individual Appliance-On CO Testing**– Turn on **only the appliance being tested** and let it warm up before reads are taken. **Warm up time is 5 minutes** for all appliances except instantaneous water heaters and cook top burners, which are **1 minute**. Always begin CO testing with the appliance with the smallest BTUh. Gas Dryers, Log Lighters, Capped Gas Lines, and appliances not affecting the living space are not CO or draft tested.
 1. **Wall Heaters / Floor Furnaces / Room Heaters (Including Heaters or Incinerators built into older ranges) / Gas Log Heaters (Freestanding / Insert / Direct Vent)**. Document Gas Log Heaters as a furnace on the Test Measurements Form. Appliance Ambient reads will be taken in the atmosphere above the top of the unit. Take Air Free Flue Gas reads after Appliance Ambient. Appliance fails if Appliance Ambient reading is 2 ppm or greater above Room Ambient, or if one or more of the CO Flue Gas air free readings are 101 ppm or greater. Note: on warm up counter flow wall heater burner(s) shall be inspected for flame interference when the fan (air handler) comes on.
 2. **Forced Air Furnaces** – Note: On warm up check burner flame for interference when the fan (air handler) comes on. Appliance Ambient read will be taken inside the supply register nearest the appliance. After Appliance Ambient reading, take Air Free Flue Gas reads in each exhaust port separately for open combustion natural draft, and inside the exhaust termination for accessible package units, and direct vent units. Appliance fails if first register reading is 2 ppm or greater above Room Ambient, or if one or more of the CO Flue Gas air free readings are 101 ppm or greater.
 3. **Water Heaters** - Appliance Ambient reads will be taken above and around top of tank. After Appliance Ambient reading, take Air Free flue gas reads on each side of baffle, and only record the higher of the two readings. Appliance fails if the Appliance Ambient is 10 ppm or greater, or if the CO Flue Gas air free reading is 101 ppm or greater.
 4. **Cook-top** – Test appliance with controls at their highest setting. All cook-top burners (including griddle), shall be turned on at the same time for the Appliance Ambient. Appliance Ambient read will be taken in the center of the kitchen. After Appliance Ambient CO reading is taken, take as measured flue gas CO readings 12 inches above the flame for each cook top burner. Operate each burner separately. Appliance fails if the Appliance Ambient is 10 ppm or greater, or if any as measured flue gas CO reading is 26 ppm or greater.
 5. **Oven/broiler** - All cook-top burners shall be turned off. All oven/broiler(s) will be turned on separately. Appliance Ambient read will be taken in the center of the kitchen 6 ft from the floor. After Appliance Ambient CO reading is taken, take as measured flue gas CO reading. Appliance fails if Appliance Ambient is 10 ppm or greater, or if the as measured flue gas CO reading is 226 or greater.
 6. **Gas Log Fireplace** - An as measured flue gas CO reading shall be taken on all gas logs in lieu of an Appliance Ambient CO read during the test in and out. Take reading just inside fireplace opening 12” above the flame. Appliance fails if the as measured flue gas CO reading is 26 ppm or greater.
 7. **Log Lighters** – Exempt from as measured flue gas CO test unless converted to Gas Log Fireplace by the presence of ceramic logs or rocks. Must be checked for gas leaks, and documented on the Test Measurements Form.

Appliance Draft Testing – Measure and record mechanical draft pressure in Pascals. Compare reading to BPI Minimum Draft Pressure table (Addendum #4 in Whole House Combustion Safety Appliance Procedures). Draft must be equal to or more negative than the BPI minimum draft pressure. Use smoke to verify the draft diverter is drawing properly on all natural draft open combustion appliances, **which includes gas logs and ovens/broilers vented to the outside.**

Combustion Ventilation Air (CVA) Fact Sheet

CVA requirements only apply to open combustion furnaces and water heaters. Abandoned appliances (capped off or disconnected only) must be included in CVA or room volume calculations. Heating appliances with flex gas connector removed, the gas line shut off valve capped or valve removed and pipe capped are considered abandoned.

Confined Space - Is an area designed for the operation of combustion appliances which has a total volume **less than 50 cubic ft. per 1000 BTU's input** of all open combustion furnaces/heaters and water heaters within the space.

Procedure for Determining if an Open Combustion Appliance is Located in a Confined Space

1. Measure enclosure or room: **L (length) X W (width) X H (height)** = Existing Area in Cubic Feet.
2. Total BTU's divided by 1000 X 50 cubic = Required Cubic Feet. Here is an easier method: Divide the total BTU input by 2, and then drop the last zero. Example: 44,000 total BTU input divided by 2 = 22,000. Drop the last zero = 2,200 cu. Ft.
3. If the result of 1 is less than 2, CVA **is** required.
4. If the result of 1 is equal to or greater than 2, CVA is **not** required.

CVA Calculation Rules

Determine the required Net Free Vent (NFV) area, **per opening(s)**, by taking the total BTU input and divide by 1000. Take the results and divide by the CVA Rule you have chosen to use. Example: The total BTU input is 80,000 BTUs. You have chosen rule 4. 80,000 divided by 1000 = 80. 80 divided by rule 4 = 20 sq. in required NFV area.

Rule 1: Requires two openings. CVA from **conditioned space** requires that each opening shall have a NFV area of at least **1 sq. in. for every 1000 BTUs** input. 1 upper vent within 12" of ceiling and 1 lower vent within 12" of floor venting to unconfined space. Each opening, **minimum 100 sq. in.**

Rule 2: Requires two openings. CVA supplied by **horizontal ducts** to the outside (**unconditioned space**). 1 upper duct and 1 lower duct. Each opening requires a NFV area of at least **1 sq. in. for every 2000 BTUs input.**

Rule 3: Requires one opening. CVA to outside (**unconditioned space**). 1 upper opening (or vertical or horizontal duct) may be used to provide the combustion air. The vent/duct must provide **1 sq. in. NFV area per 3,000 BTUs input**

Rule 4: Requires two openings. CVA to the outside (**unconditioned space**). 1 upper and 1 lower vent or vertical duct opening is required. Each opening shall have a NFV area of a least **1 sq. in. for every 4000 BTUs input.**

Note: With Rule 3, appliance must have clearances of 1 inch on sides and back and 6 inches in front from appliance to wall/door.

Note: In an unconditioned garage when it is considered a confined space, 1 vent either upper and/or lower, equal to 1 sq. in. per 4,000 BTU input for all applicable appliances is OK. The CVA opening can either be already installed, or installed by the Contractor. Must be designed CVA.

Note: If an water heater or furnace is in an enclosure that has non-standard doors (pocket, accordion, etc.) which cannot be weatherstripped, it is OK to not weatherstrip the doors, and in addition install or increase CVA to outside if necessary.

Area of a Circle (sq. in.)

Area of a Circle = Radius X Radius X 3.14

Radius = Half the diameter

3" diameter circle = 7.1 sq. in. 4" = 12.6 5" = 19.6 6" = 28.3 7" = 38.5 8" = 50.3 9" = 63.6 10" = 78.5 12" = 113

Vent Opening Multipliers

Note: Use **only one** of the following multipliers to calculate nfv. Use the multiplier that will reduce the overall NFV area to the lowest term.

Mesh, ¼ in. or Larger = **90%** of the actual vent opening.

opening. **MESH, LESS THAN ¼ in. = 50%** of the actual vent opening.

METAL LOUVERS = 75% of the actual vent

WOODEN LOUVERS = 25% of the actual vent

opening.

Estimated BTUh Input Ratings of Unmarked Open Combustion Furnaces/Heaters and Water Heaters

Wall Furnaces

Single sided: 25,000 BTUh

Double sided: 50,000 BTUh

Floor Furnaces:

Standard (usually 22" wide): 30,000 BTUh

Large (usually larger than 1 floor-joint bay): 60,000 BTUh

Forced Air Furnace:

25,000 BTUh per burner

Free-Standing Heaters:

Small: 25,000 BTUh

Standard (24" + 12" deep): 50,000 BTUh

Water Heaters:

Standard: 1000 BTUh per gallon

Tankless / Instantaneous: 200,000 BTUh