

Home Performance Assessment Report

Prepared for

Your Name
Your Address

March 2011



837 Arnold Drive, Suite 4
Martinez, CA 94553-6534
925-256-1092
Fax 925-256-1071
info@MasonBPP.com

www.BuildingPerformanceProfessionals.com



Certified Building Analyst,
Envelope Professional



H.E.R.S.
Rater



Corporate
Member

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Health & Safety

1. In worst case scenario, house tested at: -3.7 Pa. The Kitchen tested at: -3.2 Pa. At this negative pressure a natural draft appliance can back draft pulling combustion gas into the living space.
2. Moisture in the crawl space as evidenced by wet soil conditions in several locations contributes to health concerns due to the creation of mold and mildew.
3. Forced air heating systems must have less than 0.5 wc (water column) in static pressure. The tested static pressure measured 0.75 wc. This puts added stress on the furnace fan blower causing premature failure.
4. The furnace was not tested for draft due to the fact that it is a condensing flue (powered draft).
5. The combustion chamber is sealed for high efficiency furnaces.
6. The CO on the water heater was measured at 1 ppm, maximum allowed is 100 ppm
7. Original sheet metal/ joist bay floor cavities used as returns. This allows dirt, crawl space moisture, rodent droppings and fiberglass insulation to be distributed through the house.
8. The water heater makes sounds indicating that there may be a buildup of sediment.
9. Two dead rats and numerous rodent droppings were found in crawl spaces effecting indoor air quality due to infiltration from the crawl space as well as leaks in the cold air returns.

Homeowner Concerns

1. Musty smell in the house particularly on the northwest corner.
2. Comfort level in the living room.
3. High utility bills.
4. Dust in master bedroom closet

Homeowner Wish List

1. Find and eliminate source of musty smell.
2. Improve conditioning in living room.
3. Identify energy saving potential measures.
4. More energy efficient water heater.

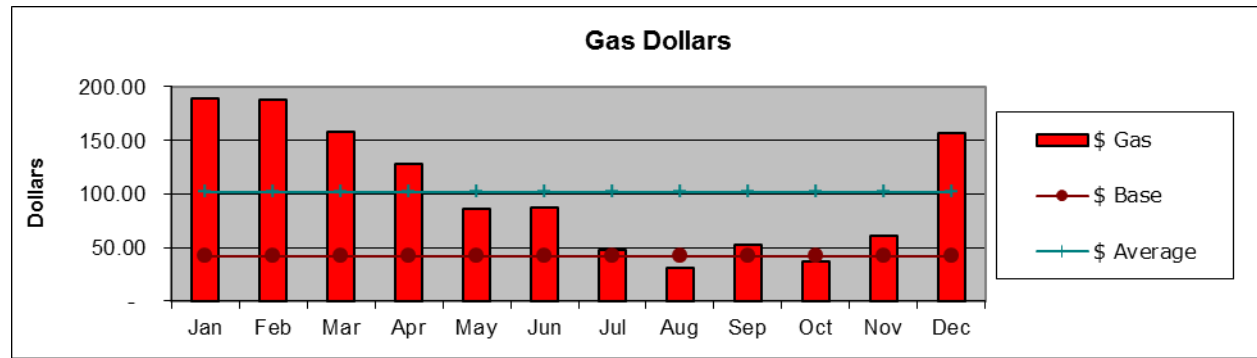
General Building Information

Total Floor Area:	3,765 square feet *
Year Built:	1933
Orientation:	Southeast
Occupants:	2 Adults, 2 Children
Pets:	1
Client Occupied:	20 years

* Based on customer estimate

Energy Usage

Natural Gas		
	Units	Cost
Base/Mo	32	\$ 41.95
Base/Yr	381	503.43
Heat	566	718.84
Other	—	0.00
Total	947	\$ 1,222.27

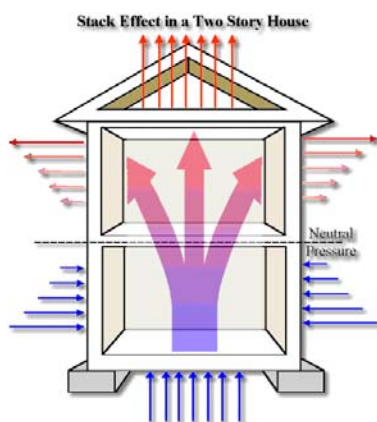


Conditions on Test Day

Indoor Temperature:	72° F
Outdoor Temperature:	56° F
Indoor Relative humidity:	61%
Outdoor Relative humidity:	80%

Weatherization

Air Leakage & Air Infiltration



Envelope leakage is a major contributor to both high energy bills, and the inability to keep the home at a comfortable temperature. As heated air rises, it escapes out of holes in the building envelope, escaping into the attic and out of the building. This rising air creates low pressure in the lower part of the home which draws cold unconditioned air into the house. When it is windy, which often coincides with those periods when heating is the most important, we see even greater rates of air change.

Replacement air is often drawn from the crawlspace and wall cavities, which can increase moisture levels and cause indoor air quality issues.

Envelope Tightness

A Blower door test is a measure of air tightness. The result of the blower door test we performed on your house was:

	Tested	Recommended
Blower Door Test CFM ₅₀	4,615	2,989
Air Changes per Hour Natural (ASHRAE 62-1989)	0.56 *	0.35 *

*Based on customer square footage of home

Areas of Infiltration/Exfiltration

- *All air infiltration sealing is done in conjunction with strategic interval testing with the blower door to monitor progress. Once the target has been met the sealing process is complete.*
 - *After air ceiling target is met the house must be retested for “Worst Case Depressurization” to verify the safety of the occupants and the structure.*
 - *After air sealing mechanical ventilation may be required. Testing with a blower door is required to attain this value.*
 - *Air sealing needs to be completed using a material that air will not penetrate. Fiberglass, blown insulation and open-cell foams are not an air barrier. Material must meet code; check with your local code department.*
1. Recessed lights:
 - a. Verify IC (insulation contact) AT (air tight), if not replace with IC AT light cans
 - b. AT cans, must be properly installed to actually be air tight.
 2. Ceiling/wall junctions in living room:
 - a. Apply paintable caulking
 3. Skylights:
 - a. Seal top of light shaft to the skylight frame
 4. Baseboard to floor connections:
 - a. Apply a small bead of appropriate clear caulk
 5. Exterior Doors:
 - a. Install new weather stripping
 6. Windows:
 - a. Install weather stripping on windows that leak air
 7. Supply and return boot connections to floors/ wall:
 - a. Seal boots with mastic (UL 181B)
 8. Attic access door/ hatch:
 - a. Re-install weather stripping. Repair and re-install ridge foam access boot. Look at what is called an attic tent (<http://www.attictent.com>).
 - b. Door must be heavy enough to resist stack and house pressures
 9. Plumbing penetrations small:
 - a. Caulk or spray foam as needed

10. Plumbing penetrations large:
 - a. Fill with ridged material such as foam board, OSB, plywood etc. the Caulk or spray foam as needed.
11. Open fireplace damper:
 - a. Close damper when not in use, install hanger to notify damper closed.
12. Fireplace damper does not close properly:
 - a. Repair or install damper at top of chimney
13. Vent fans:
 - a. Verify backdraft dampers are in place and operable
14. Tongue and groove ceiling:
 - a. Seal with clear caulk from inside, advised to test appearance before doing the all seams.
15. Leaky ducts:
 - a. Seal all seams with mastic and retest to verify results.
 - b. Recommend accessing duct sizing and a possible two zone system. One zone in the family room, rest of house second zone
16. Top plate:
 - a. Seal with caulking or spray foam
17. Interstitial spaces in the attic:
 - a. Cover and seal over

Note: *All air infiltration sealing is done in conjunction with strategic interval testing with the blower door to monitor progress. Once the target has been met the sealing process is complete. After air ceiling target is met the house must be retested for "Worst Case Depressurization" to verify the safety of the occupants and the structure.*

Moisture Management

Ventilation & Exhaust vent flows

Meet the range of recommended air changes for bathrooms (5 to 8 ACH)

1. Install a 6 mil. continuous vapor barrier over the exposed crawl space soil.
2. Install timers on bath vent fans, this allows moisture to be removed after the occupant leaves
3. Install low sones continuous operation rated bath fan

Combustion Safety

Most common fuels have carbon and hydrogen locked up and ready to heat. Add a consistent ignition source and some oxygen and we have combustion. Complete combustion will produce water, carbon dioxide and heated air. If there is insufficient oxygen the carbon will remain carbon or become carbon monoxide. Carbon monoxide is colorless and odorless. The Federal Safety Commission states that, "Carbon Monoxide is the number one cause of death by poisoning in the USA." People exposed to non-fatal CO levels experience headaches, nausea, fatigue, dizziness, which are sometimes mistaken for the flu and go untreated. The problems are not only with the devices, but how they work within the building. Examples are; competing air sources, house tightness, effects of remodeling, systems maintenance, system installations and methods of operation.

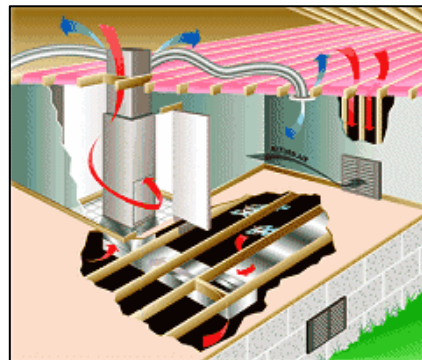
Cooktop and Oven

Location	Carbon Monoxide	
	Measured ppm	Maximum ppm allowed
Left front burner	2	<25
Left back burner	2	<25
Center front burner	3	<25
Center back burner	1	<25
Right front burner	Would not light	<25
Right back burner	2	<25

1. No service recommended, all CO levels below recommended maximum

Heating, Ventilation and Cooling Systems

The goal of Whole House Performance is to provide an indoor environment that is imperceptible to the occupants and their guests. A space that is truly comfortable is one in which the occupants don't even think about their comfort. To accomplish a comfortable and healthy space; temperature, humidity, air velocity in the occupied portion of the room, system noise levels, particles in the air, odors and mean radiant temperature, must be within a comfortable range.



Location:	Crawl space	Type of unit:	Forced Air (Bryant 92)
Fuel:	Natural Gas	Input (BTU/h):	92,000
		Existing	Specification
% Efficient (Steady State)		92%	
Static, Furnace with filter		in WC 0.7496	in WC 0.5 max
Static, Furnace without filter		in WC 0.609	
Static, Furnace filter		in WC 0.1504	
Temperature rise		70° F	° F
Carbon Monoxide (CO)		9 ppm	<100 ppm
Vent draft		NA	<0.0 Pa
Flue temperature		NA	

1. Dirty media material in filter



Distribution System

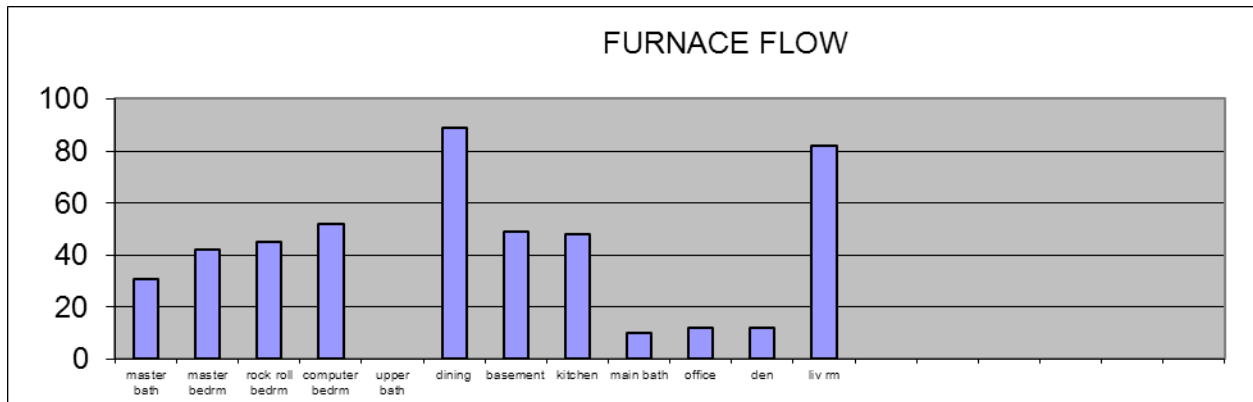
Duct Tightness Results



1. System: 1,397 CFM25 leakage—this is 76% of system air flow (overall)
2. Some dampers found in duct system
 - a. Dampers need to be installed on the individual duct runs as accessible. Where dampers exist adjustment will be necessary after duct sealing. The room by room flows need to be adjusted within 10% of Manual J. This will make the temperature room to room more consistent.
 - b. **Note:** Air flow adjustment is only as good as the system. If the existing system was sized correctly, with the proper ducts and supply grills, the adjustment will be accurate. However, if the system was not sized correctly, the adjustments will be estimated.)
3. System seams not sealed
 - a. All ducts, boots and plenums will be sealed with mastic (UL listed 181B) and tested for duct leakage.
 - b. Test to meet duct leakage goals (note: our duct leakage target) Duct leakage target to be a maximum of 6% of fan flow or 60 CFM, whichever is less. (Note: duct leakage target will be limited by areas of inaccessible duct work.)

4. Duct with sharp bends restrict air flow
 - a. Reroute any ducts with sharp bends
5. Ducts not supported properly in crawlspace
 - a. Properly support HVAC ducts every 4 feet or closer
 - b. Support straps must be min. 1½" wide and not cut or constrict duct.
6. Damaged ducts
 - a. Replace any damaged ducts
7. Dirty ducts
 - a. Clean out ducts being careful not to damage, retest to verify air tightness
8. High restrictive filter increases duct leakage
 - a. Install properly sized filter grill and 2" or 4" pleated filter; this is preferable to keep return side clean, or
 - b. Install 4" pleated filter at return plenum only after duct leakage has been fixed.
9. Duct insulation shall be a minimum R-6 value with reflective coating. R-8 to R-20 will reduce conductive losses

Supply Grill Flows



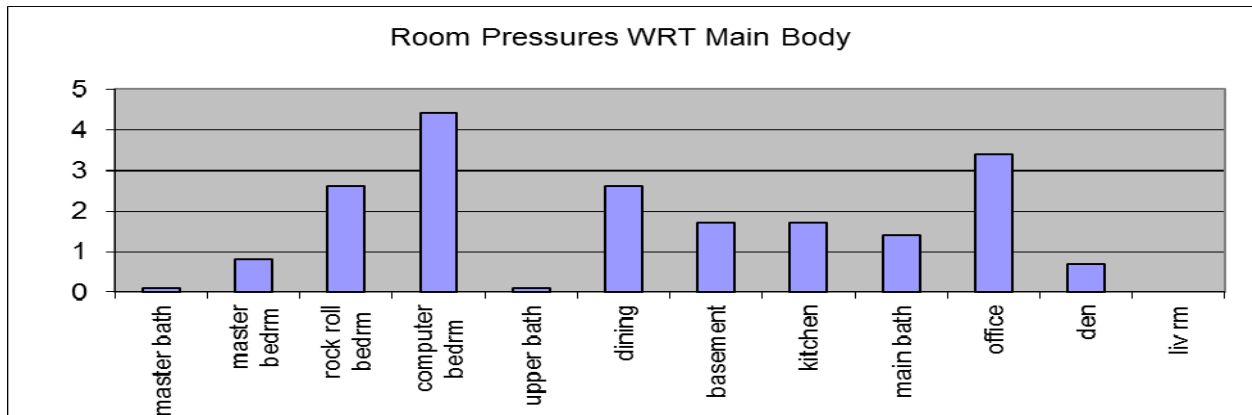
*Estimated Flows in CFM



1. Note wood blocking heat transfer

2. Poor performing grills do not allow air to mix well resulting in poor comfort:
 - a. Install new Shoemaker supply grills, sized based on the actual CFM and velocity of the room by room flows.
 - b. Wood grilles block approximately 40% of the air flow; replace with engineered flow grilles per ACCA Manual T
 - c. Grilles need to be unobstructed by furniture
3. Supply boots missing insulation
 - a. Insulate any un-insulated ducts and boots
4. Adjust room by room air flows as per ACCA M-J specifications.
5. Supply and return leakage targets, temperature rise measurements and the static pressures need to be confirmed with test equipment, and documented at the completion of process
6. Return grill is undersized, this increases static pressure reducing air flow which reduces system efficiency:
 - a. Assess location and proper size of return grill and ducts

Room Pressure Balancing



1. Room pressures should be kept below 3 Pascals across a closed room door when the HVAC system is in the cooling mode. There are several methods that can be employed to control these building pressures:
 - a. Reduce the requirement for heating and cooling so less air is needed
 - b. Large door undercuts, about 1¼", can on most rooms keep pressures within limits.
 - c. Jump ducts between the room and the main body of the house.
 - d. Transfer grills between the room and the main body of the house.
 - e. Install additional return grills
 - f. Any combination of the above

Note: After remediation, pressures across doors and "Worst Case Depressurization" must be rechecked for occupant health and safety.

Insulation

Properly performing insulation will:

1. Create a thermal barrier.
2. Enhance comfort by reducing temperature variations within the conditioned spaces.
3. Impede air leakage and water vapor transmission.
4. Reduce the size of heating and cooling equipment needed by reducing heating and cooling loads of the home.
5. Conserve energy by reducing heat transmission.
6. Reduce noise and vibration.
7. Improve the building's fire resistance.

Attic



Uneven insulation



Missing insulation

Walls



No insulation



Note studs and bracing

Crawl Space



No insulation



Wet soil—left side of photo

1. Debris found
 - a. Remove debris in crawlspace
2. Install Fan Tech low volume mechanical ventilation in crawl space, vented to the exterior of the building as per code. (0.02 CFM per square foot CBC 2301.7 IBC 1202.4) (**Note: this can only be done if no combustion appliance draws its combustion air from the crawl space.**)
3. Seal all subfloor penetrations, including electrical, plumbing water and waste pipes, tub and shower access areas, etc.
4. Insulate perimeter floor joists and joist blocking with formaldehyde-free insulation and wrap with FSK.
5. After duct work is complete, install a “Tu-Tuf” or “Astro White Double Bubble” vapor barrier.
6. Seal all penetrations through foundation walls.
7. Use foam board and FSK to block off access panels and vents to crawl space.

8. Install exterior carpet access runners for future service.
9. Supply repair kit at main access point.
10. Post crawl space warning sign for protection from future workers.
11. Mice and other rodents can completely destroy a duct system and do significant damage to floor insulation and vapor barrier. The use of a rodent control is recommended.

Domestic Hot Water System

Findings

Existing Description

Location:	Crawlspace	
Fuel:	Natural Gas	
Gallons:	40	
Input (BTU/h):	52,500	
	Existing	Recommended
Efficiency (Steady State)	80%	90%
CO	9 ppm	<100 ppm
Vent draft PASS	-3.0 Pa	< -2.0 Pa

1. Hot water pipes are not insulated
 - a. Insulate where possible; cut insulation at corners and Ts to fit, and glue or tape properly
2. Long distance to faucet
 - a. Install on demand circulating hot water pump(s) as needed

Windows



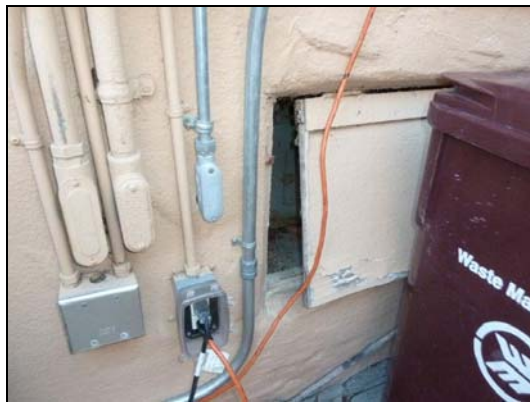
1. Windows that indicate infiltration leakage should be weather stripped where possible.

Lighting



1. Missing insulation around recessed lighting
2. Incandescent lights
 - a. Install compact fluorescent bulbs or LEDs where feasible

Exterior



Open electrical plug; panel door in disrepair



Down spout does not line up with gutter



Vent needs cleaning so damper can close



Vent damper does not close

1. Grade slopes towards house or less than 5% slope away from house
 - a. Where possible, regrade soil to a 5% slope away from the home
2. Remove/trim any vegetation that is against the house
3. Grade against stucco

Miscellaneous

1. Install new, *properly sized*, 90% or higher AFUE furnaces.
2. 90% AFUE furnaces are sealed combustion and do not need a standard chimney and cannot backdraft. This removes the possibility of combustion gas entering the living space.
3. Install a 90% or greater AFUE water heater. This removes the possibility of combustion gas entering the crawl space room.
4. Remove ozone generators:
 - a. **Air Cleaning Devices—American Lung Association site**
It is produced directly by ozone generators and indirectly by ion generators and *some other electronic air cleaners*. The FDA has set a limit of 0.05 parts...
www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=35696
 - b. **Indoor Air Facts No. 7 - Residential Air Cleaners**
Ion generators and *electronic air cleaners may produce ozone*, particularly if they are not properly installed and maintained. Ozone can be a lung irritant....
<http://www.epa.gov/iaq/pubs/airclean.html>
 - c. “Often the vendors of ozone generators make statements and distribute material that may lead the public to believe that these devices are always safe and effective in controlling indoor air pollution. For almost a century, health professionals have refuted these claims (Sawyer, et. al 1913; Salls, 1927; Boeniger, 1995; American Lung Association, 1997; Al-Ahmady, 1997)”
<http://www.epa.gov/iaq/pubs/ozonegen.html#table%201>
5. Seal leaky ducts.
6. Remove combustibles on furnace.
7. Remove items stored at base of water heater.
8. Remove air fresheners:
<http://www.arb.ca.gov/research/indoor/rediap.htm>
<http://www.epa.gov/iaq/homes/index.html>
<http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=117535>
9. Substance with the appearance of mold.
10. Recommend Toto toilet for down stairs bath, see MAP specks on ability to flush
<http://www.cuwcc.org/MapTesting.aspx>

Every home needs Carbon Monoxide detectors. Most detectors do not alarm the occupant at low levels. It is recommended to purchase and install detectors such as; NSI 3000 Low Level Monitor. California SB 183 requires existing homes and dwelling units to be outfitted with carbon monoxide (CO) alarms, beginning in July 2011.

Carbon Monoxide Monitor Comparison

	UL Listed Alarms	Other Low Level Monitors	NSI 3000 Low Level Monitor
Professional grade sensor		● ²	●
1st visual readout at 5 ppm within 30 seconds			●
Low audible alarm level at 15 ppm after 5 minutes			●
High level audible alarm at 35 ppm after 5 minutes			●
Crisis audible alarm level at 70 ppm after 30 seconds	1	●	●
Manual silence button at low levels		●	●
Cannot be silenced at crisis levels			●
Protection for all ages		●	●
Digital memory with recall	● ²	●	●
Continuous on-screen display			●
Digital CO readout	● ²	●	●
CO display range from 5-999 ppm			●
Battery operated	● ²	●	●
Can be installed at eye level	● ²	●	●
Can be converted to tabletop use			●
Sensor can be checked with match smoke		●	●
User response instructions printed on unit			●
Minimum 3-year warranty	● ²		●
Maximum protection for all age groups			●

Notes:
ppm = parts per million 1 - Allowed to take up to 240 minutes to alarm 2 - Available only on a few models

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Product Specs

- Continuous Scan™ mode lets you know monitor is checking for CO—24/7
- Digital display shows CO levels of 5ppm or higher
- 5-minute “Hush” button for levels below 70 ppm
- Low Alarm—15 ppm, audible and visual every 8 seconds
- High Alarm—35 ppm, audible and visual every 4 seconds
- Crisis Alarm—70+ ppm, audible and visual every 2 seconds—cannot be silenced
- Designed for wall installation or tabletop use
- Instantaneous Test Mode with readout to 1,000 ppm
- Replaceable 9V battery ensures operation even when power is out
- 3-Year limited Warranty

Summary

Our summary is a prioritized list of corrective and energy-saving measures based on our findings detailed in the report. Our priorities are health and safety issues first, then energy saving measures that provide the most benefit for the least cost.

Description	Estimate
1. Rodent access barrier in crawl spaces (discuss details)	\$490
2. Install vapor barrier (6 mil. Continuous) on crawl space soil (odor control)	\$1220
3. Change furnace filter	?
4. Seal leaking supply and return ducts where accessible	\$1,900
5. Insulate ducts to R-6	\$1,200
6. Air seal the structure as close to ASHRAE ventilation standards as economically reasonable	\$1,000–\$3,000
7. Weather-strip air leakage on doors and windows as necessary	\$5/lf
8. Insulate improvement/ insulate accessible walls	\$900
9. Insulate living room floor (R-19+)	\$1,248
10. Drill and fill insulation in un-insulated plaster walls at basement rec room	\$3/sf (3½")
11. Complete ACCA manual J and manual D and T calculations	\$390
12. Change registers/ducts per design criteria	?
13. Re-test CAZ9 combustion safety	Within scope of work

Glossary

ACH_n	Air Changes per Hour														
ASHRAE	American society of heating refrigeration air-conditioning engineer														
CO₂ (Carbon Dioxide)	A naturally occurring gas, and also a by-product of burning fossil fuels and biomass, as well as land-use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and therefore has a Global Warming Potential														
CO	Carbon Monoxide														
PPM (Parts Per Million)	Number of parts of a chemical found in one million parts of a particular gas, liquid, or solid. ¹														
Ampere	The unit of measurement of electrical current produced in a circuit by 1 volt acting through a resistance of 1 Ohm. ²														
BTU (British Thermal Unit)	The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit). Btu conversion factors for site energy are as follows: ² <table border="0" style="margin-left: 40px;"> <tr> <td>Electricity</td> <td>3,412 Btu/kilowatt hour</td> </tr> <tr> <td>Natural Gas</td> <td>1,031 Btu/cubic foot</td> </tr> <tr> <td>Fuel Oil No. 1</td> <td>135,000 Btu/gallon</td> </tr> <tr> <td>Kerosene</td> <td>135,000 Btu/gallon</td> </tr> <tr> <td>Fuel Oil No. 2</td> <td>138,690 Btu/gallon</td> </tr> <tr> <td>LPG (Propane)</td> <td>91,330 Btu/gallon</td> </tr> <tr> <td>Wood</td> <td>20 million Btu/cord (varies by type of wood)</td> </tr> </table>	Electricity	3,412 Btu/kilowatt hour	Natural Gas	1,031 Btu/cubic foot	Fuel Oil No. 1	135,000 Btu/gallon	Kerosene	135,000 Btu/gallon	Fuel Oil No. 2	138,690 Btu/gallon	LPG (Propane)	91,330 Btu/gallon	Wood	20 million Btu/cord (varies by type of wood)
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LPG (Propane)	91,330 Btu/gallon														
Wood	20 million Btu/cord (varies by type of wood)														
Cord of wood	A cord of wood measures 4 feet by 4 feet by 8 feet, or 128 cubic feet. ²														
EPA	Energy Information Administration														
Watt	Unit of electrical energy: one joule per second. Utility companies charge per KWH (1000 watts/ hour														
Pa	Pascal														
Natural Draft	Employs the heat of the appliance to create upward movement of flue gases														

These KEY TERMS come from the referenced Guidelines and Standards (Energy Star, EPA Indoor airPLUS, and EPA WaterSense) in the Checklist, as well as industry-driven research programs such as Building America.

AFUE Annual Fuel Utilization Efficiency	Measures the amount of fuel converted to space heat in proportion to the amount of fuel entering the furnace. This is commonly expressed as a percentage. A furnace with an AFUE of 90 could be said to be 90% efficient. AFUE includes any input energy required by the pilot light but does not include any electrical energy for fans or pumps.
Air Barrier	Any material that restricts air flow. In wall assemblies, the exterior air barrier is often a combination of sheathing and either building paper, house wrap or board insulation. The interior air barrier is typically gypsum board.
Batt Insulation	Insulation that is typically manufactured out of fiberglass into 'blankets' sized for typical framing bays and manually fitted into place. They require extra diligence to ensure no gaps, voids, compression or misalignment where framing bays are not typical framing dimensions or include wiring and piping.
Blower Door Test	Diagnostic tool designed to measure the airtightness of buildings and to help locate air leakage sites. The airtightness of a building is useful knowledge when trying to increase energy conservation or decrease indoor air pollution, or control building pressures.
Blown-in Insulation	Insulation typically made from fiberglass or cellulose that is blown into construction assemblies dry or wet that inherently fills the entire framed assembly without any gaps, voids, compression or misalignment. Typically found in attics.
Building Envelope	The outer shell, or the elements of a building, such as walls, floors, and ceilings, that enclose conditioned space.
Compression	Insulation installation condition where the full thickness is reduced, resulting in increased density and reduced air pockets that drive thermal resistance. This undermines the effective R-value of the insulation.
Construction Documents	The drawings (plans) and written specifications that describe construction requirements for a building.
Convective Air Flow	As used with thermal bypass, this refers to air-flow that occurs in gaps between insulation and the air barrier due to temperature differences in and across the gap resulting in a stack effect or driving forces from more to less heat.
Direct Vent	A sealed ventilation system for combustion appliances that draws combustion air from outside the structure and vents combustion exhaust outside the structure. These systems may be combined with power vent exhausts. See <i>Power Vent and Sealed Combustion</i> .

Duct Blaster Test	Diagnostic tool designed to measure the airtightness of ductwork and to help locate air leakage sites. Duct leakage can increase heating and cooling costs over 30% and contribute to comfort, health and safety problems.
EF (Energy Factor)	A standardized measurement of the annual energy efficiency of water heating systems. It is the annual hot water energy delivered to a standard hot water load divided by the total annual purchased hot water energy input in consistent units. The resultant EF value is a percentage. EF is determined by a standardized U.S. Department of Energy (DOE) procedure.
Energy (use)	The quantity of onsite electricity, gas or other fuel required by the building equipment to satisfy the building heating, cooling, hot water, or other loads or any other service requirements (lighting, refrigeration, cooking, etc.)
Energy Audit	A site inventory and descriptive record of features impacting the energy use in a building. This includes, but is not limited to: all building component descriptions (locations, areas, orientations, construction attributes and energy transfer characteristics); all energy using equipment and appliance descriptions (use, make, model, capacity, efficiency and fuel type) and all energy features.
ENERGY STAR® Home	A home, certified by the U.S. Environmental Protection Agency (EPA), that is at least 30% more energy efficient than the minimum national standard for home energy efficiency as specified by the 1992 MEC, or as defined for specific states or regions. ENERGY STAR is a registered trademark of the EPA.
EPA Indoor airPLUS Specifications	Construction specifications which include the careful selection of and installation of moisture control systems; heating, ventilating, and air-conditioning systems; combustion-venting systems; radon resistant construction; and low-emitting building materials.
EPA Water Sense Specifications	WaterSense, a partnership program sponsored by EPA, seeks to protect the future of our nation's water supply by promoting water efficiency and enhancing the market for water-efficient products, programs, and practices. WaterSense will help consumers identify water-efficient products and programs.
Fully Aligned	Condition where air barriers and thermal barrier (insulation) are contiguous (touching) and continuous across the entire building envelope.
H.E.R.S. or HERS (Home Energy Rating System)	A standardized system for rating the energy-efficiency of residential buildings.

HERS Score	A value, typically between 0 and 100, indicating the relative energy efficiency of a given home as compared with the HERS Energy-Efficient Reference Home as specified by the HERS Council Guidelines. The lesser the score, the more efficient the home. A home with zero energy use for the rated energy uses (heating, cooling and hot water only) scores 0 and the HERS Reference Home scores 100. A home must beat the baseline score of 100 by 15% (minimum rating of 85) to qualify for the Energy Star rating.
Housewrap	Any of several spun-fiber polyolefin rolled sheet goods for wrapping the exterior of the building envelope.
HSPF (Heating Season Performance Factor)	A measurement of the seasonal efficiency of an electric heat pump using a standard heating load and outdoor climate profile over a standard heating season. It represents the total seasonal heating output in Btu divided by the total seasonal electric power input in watt-hours (Wh). Thus, the resultant value for HSPF has units of Btu/Wh.
Infrared Thermal Imaging	Heat sensing camera which helps reveal thermal bypass conditions by exposing hot and cold surface temperatures revealing unintended thermal flow, air flow, and moisture flow. Darker colors indicate cool temperatures, while lighter colors indicate warmer temperatures.
Insulation Contact, Air-Tight (ICAT) Lighting Fixture	Rating for recessed lights that can have direct contact with insulation and constructed with air-tight assemblies to reduce thermal losses.
Jump Duct	A flexible, short, U-shaped duct (typically 10-inch diameter) that connects a room to a common space as a pressure balancing mechanism. Jump ducts serve the same function as transfer grilles.
Load	The quantity of heat that must be added to or removed from the building (or the hot water tank) to satisfy specific levels of service, such as maintaining space temperature or hot water temperature at a specified thermostat setting (see also the definitions of energy and thermostat).
Low-E	Refers to a coating for high-performance windows, the "E" stands for emissivity or re-radiated heat flow. The thin metallic oxide coating increases the U-value of the window by reducing heat flow from a warm(er) air space to a cold(er) glazing surface. Low-E coatings allow short-wavelength solar radiation through windows, but reflect back longer wavelengths of heat.

Manual D	The methods and procedures that should be used to design residential duct systems. Residential duct systems have a direct and significant effect on equipment size, equipment efficiency, equipment malfunctions, envelope infiltration, operating cost, utility demand loads, vent performance, exhaust system performance, indoor air quality, ambient noise, occupant comfort and owner satisfaction. Therefore, the duct system must be carefully designed and properly installed or the potential benefits that are associated with building an efficient structure and using high efficiency equipment will not materialize.
Manual J	Method for calculating heat loss from the building through walls and ceilings, leaky ductwork, and infiltration through windows, doors, and other penetrations as well as heat gain into the building from sunlight, people, lights and appliances, doors, walls, and windows, and infiltration through wall penetrations. Design conditions for the area are also used as inputs into load calculations.
Manual S	Procedure to select and size heating and cooling equipment to meet Manual J loads based on local climate and ambient conditions at the building site. Manual S covers sizing strategies for all types of cooling and heating equipment, as well as how to use comprehensive manufacturer's performance data on sensible, latent, or heating capacity for various operating conditions.
Mechanical Ventilation	The active process of supplying or removing air to or from an indoor space by powered equipment such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows.
Microirrigation system	Method where water is applied at or below the soil surface at low pressure and low volume.
Misalignment	Condition where air barrier and thermal barrier (Insulation) are not contiguous (touching) and not continuous across the entire building envelope.
Performance Test	An on-site measurement of the energy performance of a building energy feature or an energy using device conducted in accordance with pre-defined testing and measurement protocols and analysis and computation methods. Such protocols and methods may be defined by national consensus standards like those of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the American Society for Test and Measurement (ASTM).

Perm	A unit of measure of water vapor permeance. One perm equals one grain of water vapor per hour flowing through one square foot of material at a differential vapor pressure equal to one inch of mercury. The greater the number, the more water vapor that will pass through a given material.
Power Vent	A sealed exhaust ventilation system for combustion appliances that uses a fan to move combustion exhaust out of the structure. See <i>Direct Vent and Sealed Combustion</i> .
Pressure Boundary	The point in a building at which inside air and outside air are separated. If a building were a balloon, the rubber skin would form the pressure boundary. Where inside and outside air freely mingle there is no pressure boundary.
Pressurization Test	A procedure in which a fan is used to place a house, duct system, or other container, under positive or negative air pressure in order to calculate air leakage.
RESNET (Residential Energy Services Network)	The national association of energy rating providers.
Rated flow rate	The flow rate of the showerhead when tested in accordance with ASME A112.18.1/CSA B125.1.
Rated Home	A specific residence that is evaluated by an energy rating.
Rigid Insulation	Insulation typically made from polystyrene or polyurethane manufactured into 4' x 8' boards of various thicknesses. As an exterior sheathing material, rigid board insulation provides a complete thermal break assembly and can effectively shift the dew point outside of the exterior wall construction assembly.
R-value	A measure of the thermal resistance of a material. Higher R-values indicate better resistance to heat flow through material. The effective R-value of an insulation material will be reduced by gaps, voids, compression or misalignment.
Sealed Combustion	Sealed combustion means that a combustion appliance, such as a furnace, water heater, or fireplace, acquires all air for combustion through a dedicated sealed passage from the outside; combustion occurs in a sealed combustion chamber, and all combustion products are vented to the outside through a separate dedicated sealed vent. See <i>Direct Vent and Power Vent</i> .

SEER (Seasonal Energy Efficiency Ratio)	A measurement similar to HSPF except that it measures the seasonal cooling efficiency of an electric air conditioner or heat pump using a standard cooling load and outdoor climate profile over a standard cooling season. It represents the total seasonal cooling output in Btu divided by the total seasonal electric input in watt-hours (Wh). The SEER value are units of Btu/Wh.
Semi-Permeable	The term vapor semi-permeable describes a material with a water vapor permeance between 1 and 10 perms. Water vapor can pass through a semi-permeable material but at a slow rate.
Solar Heat Gain Coefficient (SHGC)	SHGC measures how well a window blocks heat caused by sunlight. The lower the SHGC rating the less solar heat the window transmits. This rating is expressed as a fraction between 0 and 1. The number is the ratio of a window's solar heat admittance compared to the total solar heat available on the exterior window surface at normal solar incidence (i.e., perpendicular to the glazing surface).
Spray Foams Insulation	Insulation available in both open- and closed-cell configurations that is typically made from polyurethane. It is sprayed into construction assemblies as a liquid that expands to fill the surrounding cavity. Once dry, spray foam functions as both an air barrier and thermal barrier and effectively fill holes and cracks for both a well-insulated and air-tight wall assembly. Closed-cell spray foams are denser and also function as a vapor barrier.
Supply Ducts	The ducts in a forced air heating or cooling system that supply heated or cooled air from the air conditioner to conditioned spaces.
Thermal Barrier	Term used to describe when flow of heat is restricted or slowed. This is accomplished through insulation.
Thermal Bridging	Accelerated thermal flow that occurs when materials that are poor insulators displace insulation (such as framing material).
Thermal Bypass Checklist	Comprehensive list of building details for ENERGY STAR Qualified Homes addressing construction details where air barriers and insulation are commonly missing.
Thermal Bypass	The movement of heat around or through insulation. This typically occurs when gaps exist between the air barrier and insulation or where air barriers are missing.
Thermal Boundary	The border between conditioned and unconditioned space where insulation should be placed.

Thermostat	A control device that measures the temperature of the air in a home or the water in a hot water tank and activates heating or cooling equipment to cause the air or water temperature to remain at a prespecified value, normally called the set point temperature.
Ton(s) of Refrigeration	Units used to characterize the cooling capacity of air conditioning equipment. One ton equals 12,000 Btu/h.
U-Value	Measures the rate at which heat flows or conducts through a building assembly (wall, floor, ceiling, etc.). The smaller the u-value the more energy efficient an assembly and the slower the heat transfer. Window performance labels include U-values (calling them U-factors) to help in comparing across window products.
Vapor Diffusion	Vapor diffusion describes the molecular process in which vapor moves moisture from areas of higher vapor pressure to areas of lower vapor pressure, and from areas of greater temperature to areas of lesser temperature.
Vapor Diffusion Retarder	The function of a vapor diffusion retarder is to control the entry of water vapor into building assemblies through the mechanism of vapor diffusion. The effectiveness of a vapor diffusion retarder is based on its perm rating. See <i>Perm</i> and <i>Vapor Diffusion</i> .
Ventilation	The controlled movement of air into and out of a house.
WaterSense labeled bathroom sink faucet	These faucets have a flow rate that does not exceed 1.5 gallons per minute (gpm) (5.7 lpm) at a pressure of 60 psi (414 kPa) at the inlet when water is flowing, and is not less than 0.8 gpm (3.0 lpm) at a pressure of 20 psi (1.38 kPa) at the inlet when water is flowing. The WaterSense high-efficiency bathroom sink faucet specification can be found at http://www.epa.gov/watersense/specs/faucet_final.htm and a list of labeled faucets and faucet accessories can be found at http://www.epa.gov/watersense/pp/lists/find_faucet.htm .
WaterSense labeled tank-type high-efficiency toilet	These toilets have a flush volume that does not exceed 1.28 gallons (4.8 liters), have a solid waste removal of 350 grams or greater, and conform to the adjustability and other supplementary requirements included in the WaterSense high-efficiency tank-type toilet specification. This specification can be found at http://www.epa.gov/watersense/specs/het.htm and a list of labeled toilet models can be found at http://www.epa.gov/watersense/pp/find_het.htm .



837 Arnold Dr., Ste.4 Martinez, CA 94553-6534

925-256-1092 ■ Fax 925-256-1071

info@masonbpp.com

WWW.BUILDINGPERFORMANCEPROFESSIONALS.COM