HOME INSPECTORS OF TENNESSEE ASSOCIATION
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Member Inspector

A.O. Smith UNIVERSITY
An Education in Hot Water

HOME INSPECTOR EDUCATION EXPO 2016

Residential Water Heater Inspection

Course Objective

Completing this course should enable an inspector to identify components of gas-fired and electric residential water heaters; recognize defects and safety hazards in relation to modern standards and manufacturer requirements; explain how a flammable vapor ignition resistance system (FVIR) works; recognize the importance of temperature-and-pressure relief valves and the importance of checking confined spaces.

NOTE This course in not intended to be a code compliance course. All standards and requirements covered in the course are superseded by any and all national, state, and local code enforcement.

Course Outline

- Location Requirements
- Standard Installation Practices
- Basic Operation
- Resources


LOCATION,
LOCATION,
LOCATION.

Closets

- Gas water heaters should not be installed in a room used as a storage closet.
- Closet doors should be of louvered design.

Bedroom/Bathroom

- Gas water heaters should not obtain combustion air from sleeping rooms, bathrooms or toilet rooms. There are two exceptions:

1. Installed within a sealed enclosure behind a solid weather-stripped door that prevents the water heater from pulling combustion air from the living space. The door must be self-closing.

2. The water is of direct vent design.

Garages

- Gas water heaters with an open source of ignition should be elevated not less than 18 inches above the garage floor or be FVIR compliant.

- The water heater should be installed in such a way that physical damage would be prevented from any impact.

Attics

A suitable access opening, passageway, and workspace is required for attic installations.

- The access opening should be large enough to accommodate removal of the water heater.
- The passageway should not be more that 20’ long, be at least 30” wide, and have continuous flooring at least 24” wide.
- There should be a level workspace at least 30” wide at the service side of the water heater

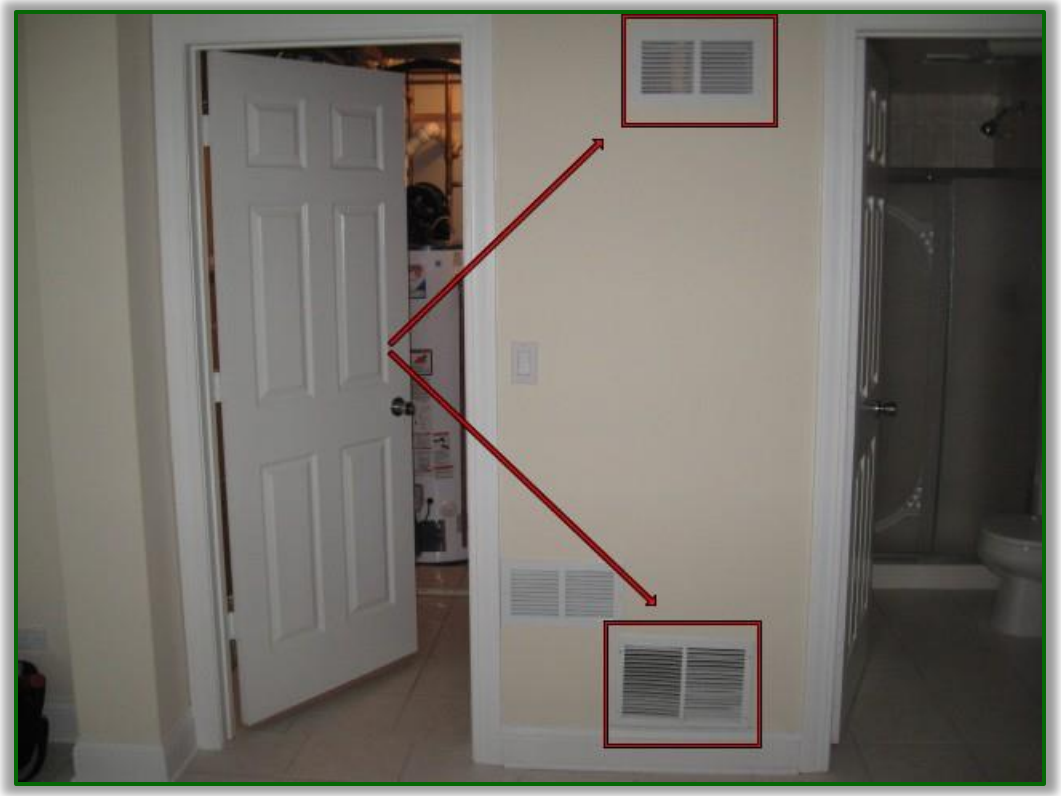
Mechanical Rooms

- Gas water heaters should not be installed in a room containing air-handling equipment when that room is used as a plenum.

Confined Spaces

A space is defined as “confined” if the volume of space in which the water heater is located is less than 50 cubic feet of space per 1,000 Btu of input.

(50 cubic feet = 2.5ft. X 2.5ft. X 8ft.)



Standard Installation Practices

Accessibility

Water heaters should be accessible for routine inspections, maintenance, adjustments, repairs and replacements.

- "Accessible" means to reach the water heater by possibly first removing a panel, door, or similar obstruction that is part of the water heater.

- "Accessible" does not mean the removal of finish materials, such as drywall, paneling, or built-in cabinets.

Labeling

- All water heaters are manufactured with labeling that contain vital information for safe and reliable operation. These labels must be visible.

- All water heaters are manufactured with a data plate that indicates the model and serial number as well as other vital information like fuel type. The water heaters data plate should always be present.

Seismic Support

In areas that have earthquake risk, it is important that a water heater be fastened in place with straps to avoid damage.

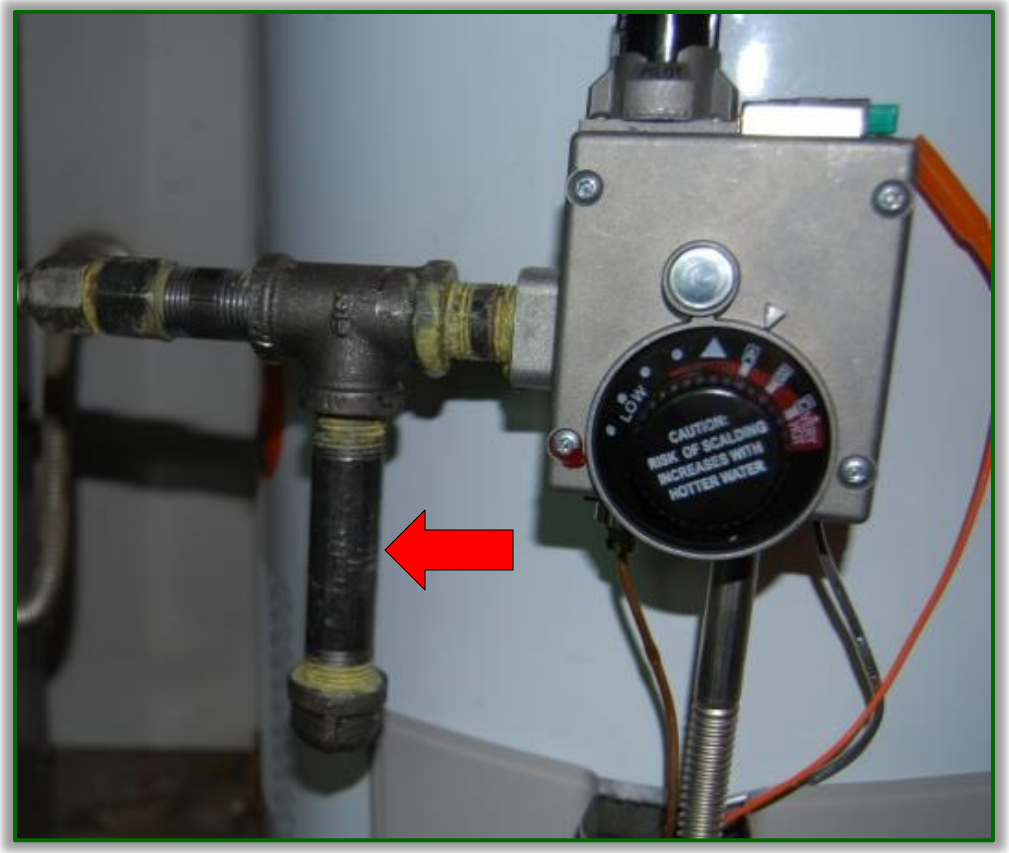
- Top strapping should be located in the upper one-third and the lower one-third of the units vertical dimension.
- The lower strapping should maintain a minimum distance of 4” above the controls.
- In addition to strapping, approved flexible connectors should be used.

Water Valves

- A water valve should be installed in the main cold water supply. The valve should be located near the water heater and accessible from the same floor level.
- The water valve should be of a full-open design as to not cause flow restriction. Ball valves are preferred.

Fuel Shut-off Valves

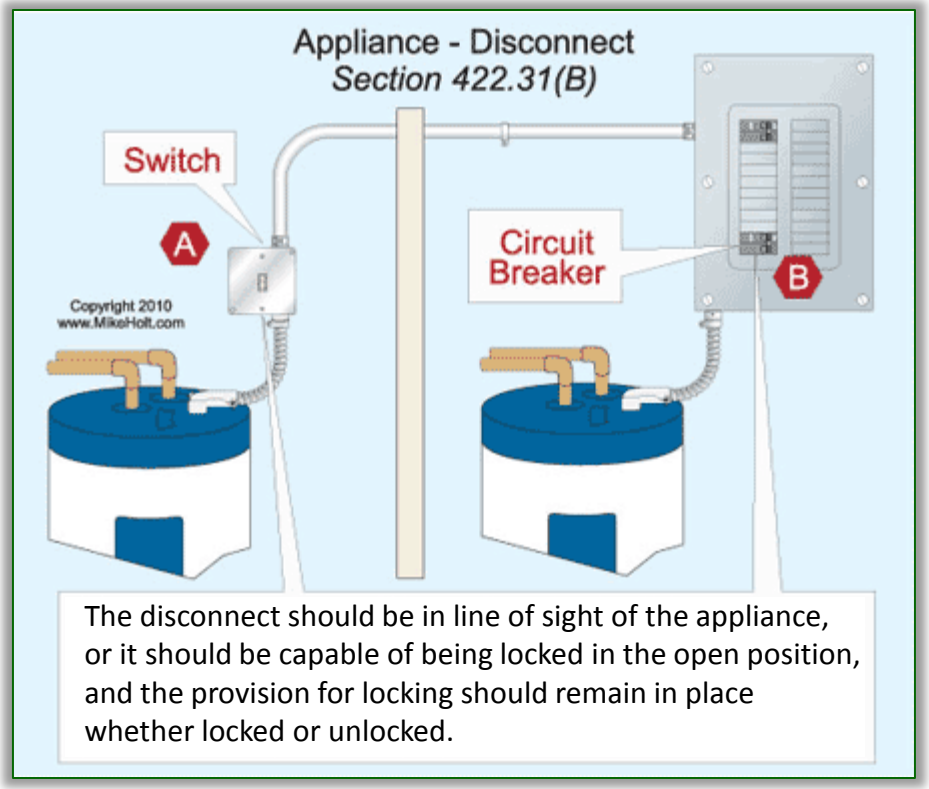
- A fuel shut-off valve for service, repair, and emergency shut-down should be installed for all gas water heaters.
- Fuel lines feeding gas water heaters should also incorporate a “drip leg” or “dirt leg” to prevent moisture and debris from entering the control.



Electrical Disconnects

- An electrical disconnect for service, repair, and emergency shut-down should be installed for all electric water heaters.

- The service wiring that supplies power to the water heater should be tightly secured with strain reliefs.



Venting requirements

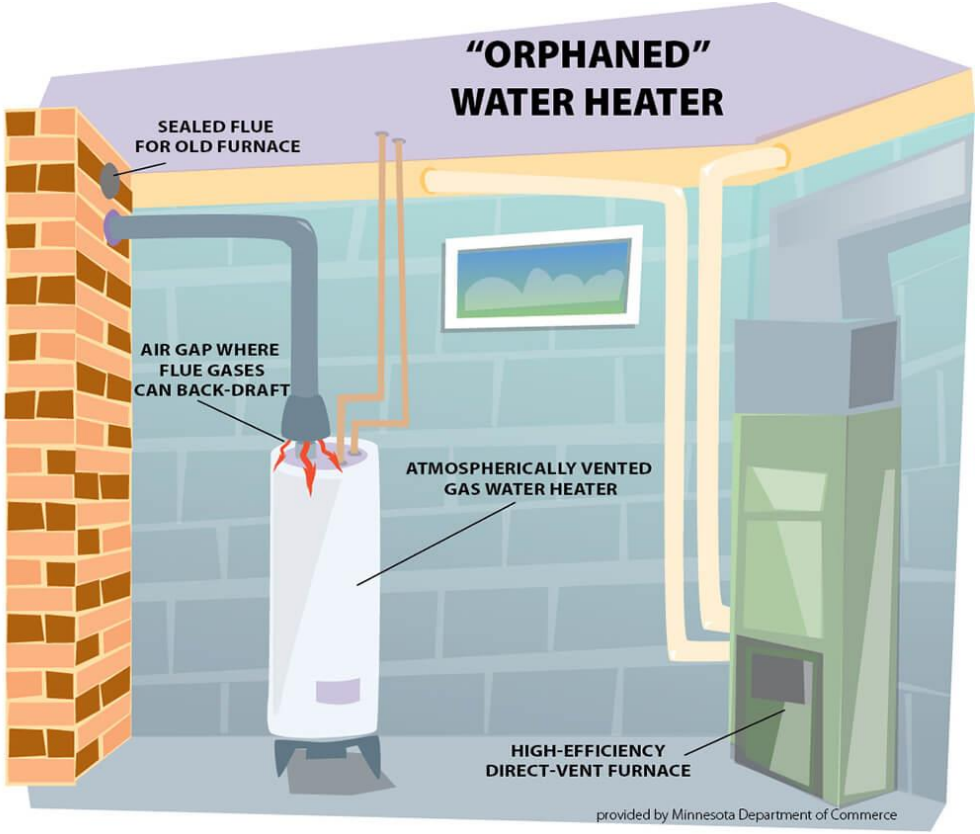
- UL listed Type B double or single wall metal vent pipe must be used. Some local codes may be more restrictive and not allow single wall.
- Single wall pipe may not pass through attic spaces, crawl spaces, confined inaccessible locations, or interior walls.
- Single wall pipe must maintain a 6” clearance from combustible material.
- Clearances for double wall pipe will be specified by the manufacturer.

Venting requirements

- To improve the flow of exhaust gases, we recommend that a minimum of 12” of vertical pipe be installed on the draft hood.
- Any horizontal runs should not be more than 75% of the total vertical rise. Horizontal runs should rise by ¼” per foot.
- If local codes allow, gas water heaters may terminate into an existing chimney. Otherwise, it must terminate vertically.

Water Heater Installation

Orphaned water heaters



Temperature and Pressure (T&P) relief valves

- In order to accurately sense the water temperature, the T&P valve must be located in the upper 6” of the water heater.
- The T&P valve should be visually and manually inspected to insure proper operation.

T&P discharge pipes

- The pipe should be constructed of materials tested, rated, and approved for such use.
- The pipe should not be directly connected to the draining system.
- The pipe should discharge through an air gap located in the same room as the water heater.
- The pipe should not be smaller than the diameter of the outlet valve it serves.
- The pipe should not have valves or tee fittings installed.
- The pipe should not have a threaded end.
- The pipe should serve one outlet valve only.

T&P discharge pipes

- The pipe should discharge to a positive drain.
- The pipe should not terminate more than 6” from the floor or drain.
- The pipe should discharge in a manner that does not cause personal injury or structural damage.
- The pipe should be installed as to flow by gravity.
- The pipe should discharge to a termination point that is readily observable by the building occupants.
- The pipe should not be trapped.

Sacrificial Anode Rod

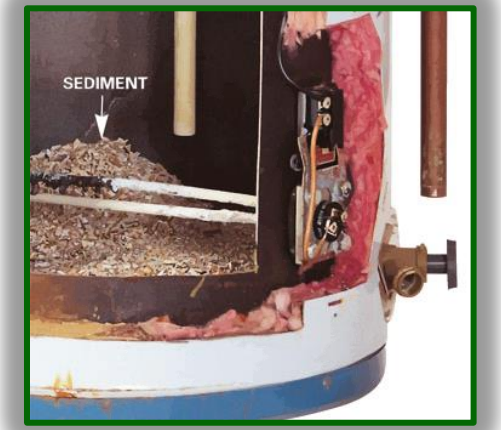
- The anode rod is a sacrificial metal rod that helps avoid corrosion and premature failure. The anode rod is a consumable item and will need to be replaced periodically. If the home has a water softener, the anode will deplete faster than normal.

Drain Pan

- The water heater should be installed in a drain pan when if it is located in an area where a leak would cause structural or property damage.
- The drain pan should not be less than 1.5” deep.
- A good rule of thumb on size is at least 2” larger than the diameter of the tank.

Drain Valve

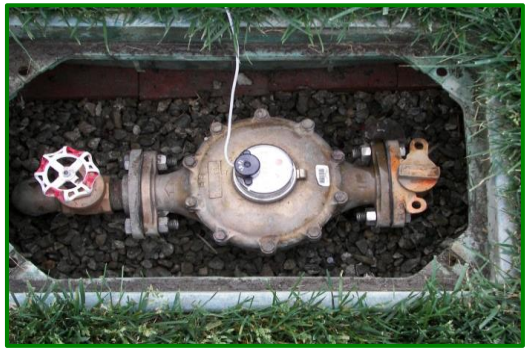
- All water heaters should have a drain valve installed for service, maintenance, sediment removal, repair, and replacement.
- We recommend flushing the water heater through the drain valve annually to remove sediment.

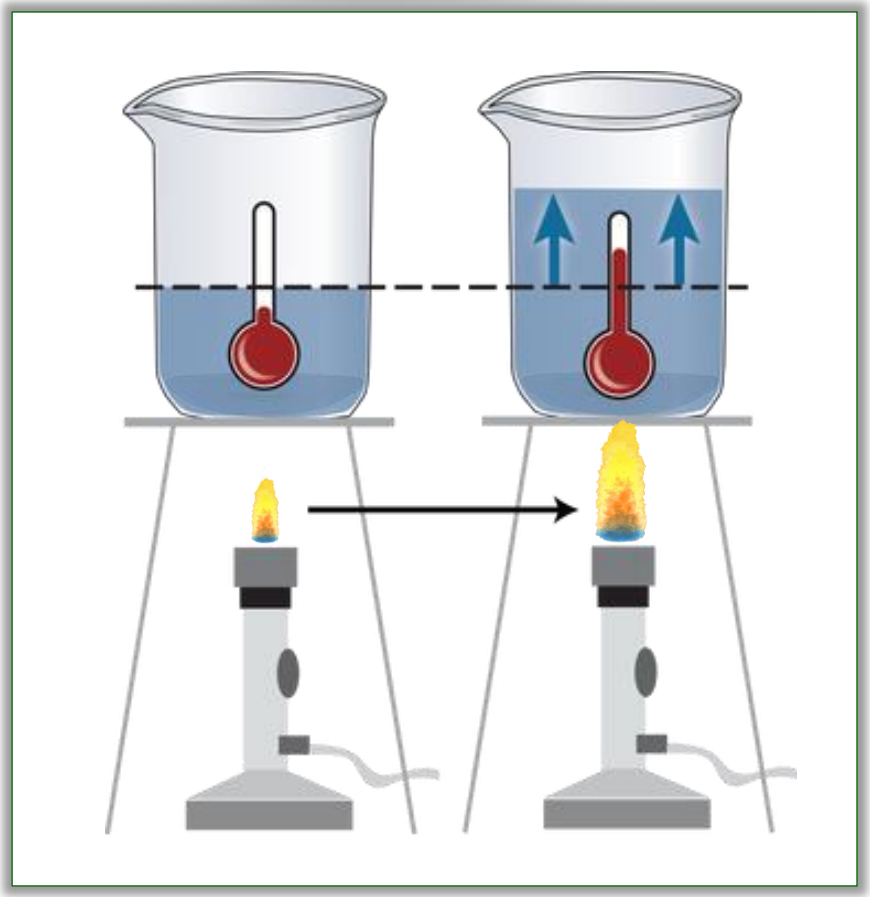


Thermal Expansion Tanks

- All “closed” plumbing systems requires a thermal expansion control device such as a thermal expansion tank.

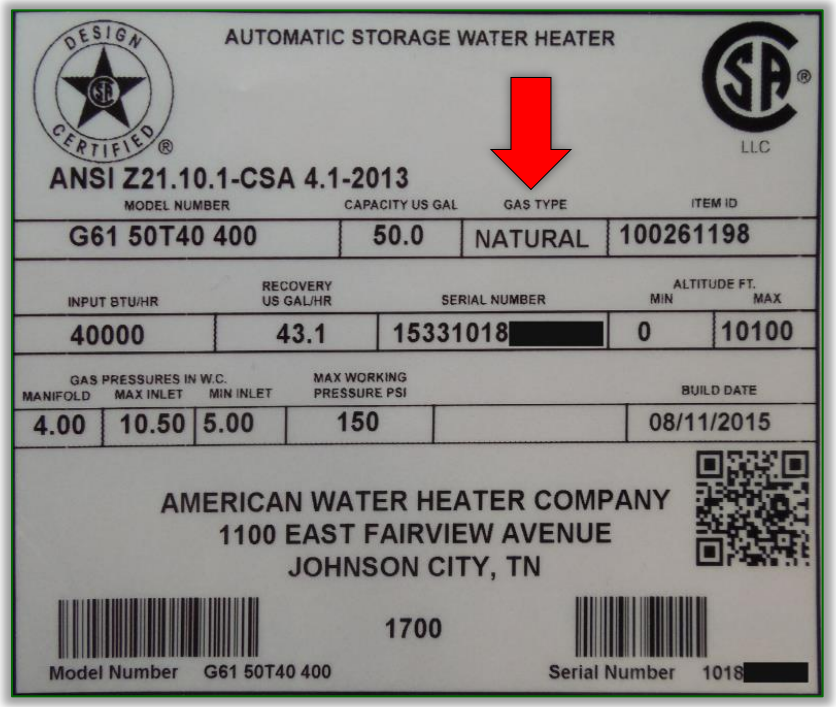
- Water expands when it is heated. Since the water is unable to expand back into the municipal system, the thermal expansion tank will absorb the expansion.





Fuel Conversions

- Fuel conversions are only allowed when converting from LP gas (propane) to natural gas. The conversion of a gas water heater from natural gas to propane is NOT allowed.
- The current fuel being used should match the fuel designation on the water heater's data plate.



Defects

- Check for physical damage to the water heater particularly rust and corrosion on the bottom of the water heater. Check for water marks on the floor. The inspection covers should not be disturbed. Check for scorching around the burner door. The outer door should be in place.

Basic Operation

Temperature regulation

- The magic number is **120**.

- According the ASSE 1070, the water heater should not be the sole device for temperature control.

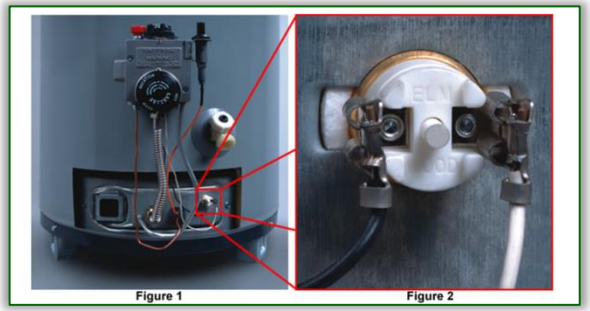
Table 1	
Temperature	Time to Produce a Serious Burn
120°F (49°C)	More than 5 minutes
125°F (52°C)	1½ to 2 minutes
130°F (54°C)	About 30 seconds
135°F (57°C)	About 10 seconds
140°F (60°C)	Less than 5 seconds
145°F (63°C)	Less than 3 seconds
150°F (66°C)	About 1½ seconds
155°F (68°C)	About 1 second

Water Pressure

- Most local codes dictate a maximum water pressure of 80 psi for residences.
- For water pressure above 80 psi, a Pressure Reducing Valve (PRV) should be installed.
- To help avoid premature failure, we recommend an operating pressure of 50 – 60 psi.

Flammable Vapor Ignition Resistant (FVIR)

- In 2003, a new standard for water heaters was developed that states “the water heater should NOT ignite flammable vapors outside the water heater created by the spilling of gasoline onto the floor.”
- FVIR compliant water heaters typically have three components in common:
  - ✓ A Lint, Dust, Oil (LDO) screen
  - ✓ A flame arrestor plate
  - ✓ A thermal cut-off switch



Burner Flame

- The burner flame should be clear blue with slightly yellow tips.
- The burner flame should not appear to be erratic, “searching” or “rolling out.”
- The presence of soot would also be an indication of a lack of make-up air.

Proper Draft Test

- You will need something to generate smoke such as a candle, cigar, or cigarette…anything that will produce smoke.
- Close all building doors and windows and all doors between the water heater location and other portions of the building. Also, close fireplace dampers.
- Turn on all air-moving appliances, such as clothes dryers, kitchen and bathroom exhaust fans, range hoods, and the heating furnace. Also, make sure that any other gas-burning appliance is operating.

Proper Draft Test

- Next, open a hot water faucet so that the burner will fire continuously.
- After the unit has been firing for approximately 5 minutes place the source of smoke close to the opening of the draft hood. The smoke should be pulled into and up the draft hood and not float around the draft hood.
- If the smoke does not continue to be pulled up the draft hood into the vent or blows back into the room, you have a venting problem that needs immediate attention.

Leaks

- If you see small puddles of water in the drain pan or hear sizzling sounds as water drips on the burner, the water heater may be producing condensation.
- If there is water on the floor around the bottom of the water heater, check the plumbing connections on top of the water heater. Use a dry paper towel to wipe around the hot and cold pipe connections on top of the water heater.
- If the hot and cold water connections are not leaking, check the T&P relief valve discharge pipe. In most cases, drips from your water heater's T&P relief valve discharge pipe mean the home's water pressure is too high or the home's thermal expansion tank has failed


HELP
TIPS
ASSISTANCE
GUIDANCE
SUPPORT
ADVICE

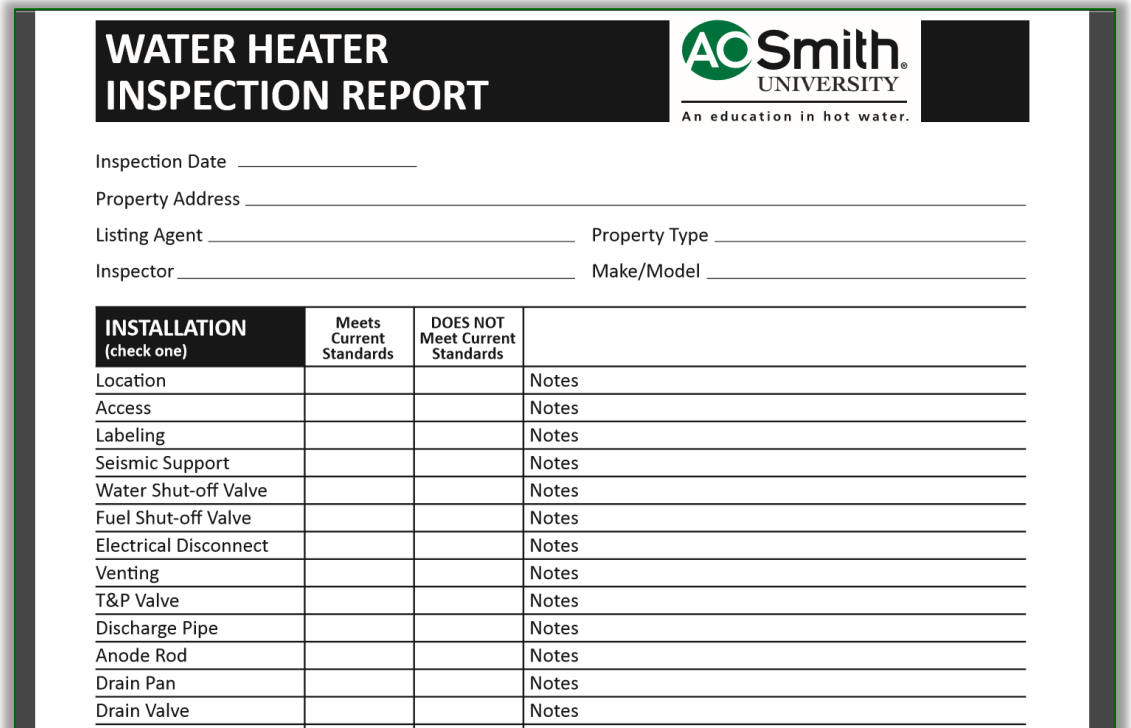
Home Inspectors of Tennessee Association

Home Inspector Education Expo 2016

Sept 30th-Oct 1st
Chattanooga Convention Center
Two Carter Plaza, Chattanooga, Tennessee

PDF – HITA Expo Brochure

Water Heater Inspection Checklist



WATER HEATER INSPECTION REPORT

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Inspection Date _____

Property Address _____

Listing Agent _____ Property Type _____

Inspector _____ Make/Model _____

INSTALLATION (check one)	Meets Current Standards	DOES NOT Meet Current Standards	
Location			Notes
Access			Notes
Labeling			Notes
Seismic Support			Notes
Water Shut-off Valve			Notes
Fuel Shut-off Valve			Notes
Electrical Disconnect			Notes
Venting			Notes
T&P Valve			Notes
Discharge Pipe			Notes
Anode Rod			Notes
Drain Pan			Notes
Drain Valve			Notes

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THANK YOU

Jason Leonard – A.O. Smith