link for Service manuals and other useful information and illustrations:
http://waterheatertimer.org/How-to-troubleshoot-gas-water-heater.html#pilot

Pilot light will not stay lit

- Too small a pilot flame, flame is not clear blue (clean combustion parts and combustion chamber)
- Bad thermocouple (replace) How to test thermocouple: Light pilot. Release pilot button after 60 seconds. If pilot goes out, then thermocouple is probably bad
- No gas at pilot: ECO or energy cut off stops gas flow to pilot and burner if overheating condition occurred. If pilot will not ignite at all, then ECO is probably tripped, or gas valve is bad. (Replace gas control valve and/or re-set ECO if model has thermal protection switch located on front of combustion door) If gas is available and some flame is present, the ECO is not tripped.
- Bad gas valve (replace)
- Water, rust inside combustion chamber can mean vent condensate dripping down water heater and extinguishing flame. Can also mean vent cover missing and rain entering water heater. (Check condition of vent pipes)
- Pilot light burns/ goes out later: (Test for proper air draw up vent, check for spillage. Open window and get more fresh air to water heater, FVIR tripped)

Pilot and burner ignites, but creates black soot:

Clean burner and tube


Pilot orifice

- Dirty/Blocked Burner Tube (Clean)
- Dirty Pilot Orifice (have cleaned by qualified person, also clean with carburetor cleaner and compressed air)
- Bad LP pressure (have set by qualified person), low NG pressure (call gas company), not enough fresh air

* Check thermocouple is securely screwed into thermostat assembly. Finger tight plus 1/4 turn
* Check that end of thermocouple is sitting in the pilot light flame, and not fallen away.


Thermocouple

---

* Thermocouple may have failed and requires replacement: remove old thermocouple and take to hardware store for matching replacement. Take photos before removal. Read manual. Some thermocouples require removal of burner.
* Condensation dripping down vent can extinguish pilot light. This implies venting issue, inspect vent for holes, light match under vent hood and see if draft pulls smoke immediately upward.
* Thermocouple and pilot tubes must have gradual bends without kinks or pinches
* Make sure gas is turned on. Gas shut-off handle must be parallel with gas line.
* Gas pressure may be low, check pressure or have utility company check pressure
* Galvanized pipe is not suitable for gas line. Galvanized flakes will stick inside gas control valve. Replace gas control valve and replace galvanized pipe with black pipe or flexible yellow gas line.
* Thermostat may have failed and requires replacement. Refer to part number in manual or on side of gas valve.

Gas control valve thermostat

* Air or dirt in gas line can cause loss of gas: dis-assemble and clean or replace
* Pilot line or orifice may be clogged. Read manual for yearly cleaning and maintenance procedure.

* Are other gas appliances working? If not, check with gas company
* Was a new power-vented appliance recently installed in house? This can draw air down water heater vent.
* Inadequate combustion air can cause water heater to shut down for safety reasons. Open doors and window.
* If vent is shared with furnace, vent air from other gas appliance can blow out pilot.
* Improper venting on roof can cause backdraft that blows out pilot. Vent must meet local code. Call plumber.
* Do not expose water heater to stored chemicals like bleach and pool chemicals. Avoid corrosive atmospheres.

Vent problems: READ about NEGATIVE PRESSURE below

* Read manual for necessary yearly maintenance on burner. Also see illustrations below .
* Replace burner and pilot assembly. See Fig 4

Troubleshoot chart with cause and action:

Unable to light pilot	1. Gas supply turned off 2. Gas cock knob dial not positioned correctly 3. Defective thermocouple 4. Defective safety magnet assembly 5. Pilot burner orifice clogged 6. Pilot tube pinched or clogged 7. Poor thermocouple connection 8. Air in gas line 9. Thermostat's single use ECO is tripped 10. Gas valve defective	Turn on gas supply Check lighting instructions. Set control knob Check and replace thermocouple Check and replace gas valve Clean or replace Clean, repair or replace Check and tighten Purge air from gas line Check ECO and replace gas valve Check gas valve
Pilot does not light Pilot does not stay lit	1. Poor thermocouple connection 2. Thermocouple defective 3. Thermocouple not in pilot flame 4. Defective safety magnet assembly 5. Venting downdraft (or other improper draft) 6. Clogged flue 7. Pilot partially clogged 8. Improper gas pressure	Tighten connection at gas valve Check thermocouple and replace Move tip of thermocouple so it is immersed in pilot flame Check magnet and replace gas valve Check for proper up draft venting. Check for other drafts that could blow out the pilot light Inspect and clean flue way Inspect and clean supply tube and pilot burner Check and adjust supply side
	9. Negative pressure 10. Backdraft 11. Water dripping down vent	Turn off all household vent fans to see if pilot will light. Ventilate water heater location. Raise height of outdoor vent termination. Power vent models: install condensate tee. Correct venting problem
PILOT WILL NOT LIGHT OR REMAIN LIT Power vent	1. Low gas pressure 2. Air in gas line 3. No gas 4. Dirt in gas lines 5. Pilot line or orifice clogged 6. Thermocouple connection loose 7. Defective thermocouple 8. Cold drafts 9. Thermostat ECO switch open** 10. Pilot and bleed tubes switched at the thermostat	1. Check with gas utility company 2. Bleed air from gas line. 3. Check with gas utility company 4. Notify utility-install dirt trap in gas line 5. ***Clean, locate source and correct 6. Finger tighten-then 1/4 turn with wrench 7. Replace thermocouple 8. Locate source and correct 9. Replace thermostat 10. Switch pilot and bleed tube at the fittings located on the thermostat bottom.
Main burner will not stay lit	1. Low gas pressure 2. Main burner orifice clogged 3. Main burner supply tube clogged or pinched 4. Defective magnet assembly 5. Defective thermocouple 6. Poor thermocouple connection 7. Defective main valve 8. Improper venting	Check gas supply pressure Clean or replace Clean, repair or replace Check and replace gas control valve Check and replace thermocouple Inspect and tighten Replace gas control valve Check venting for proper sizing and down drafts

Fig 1

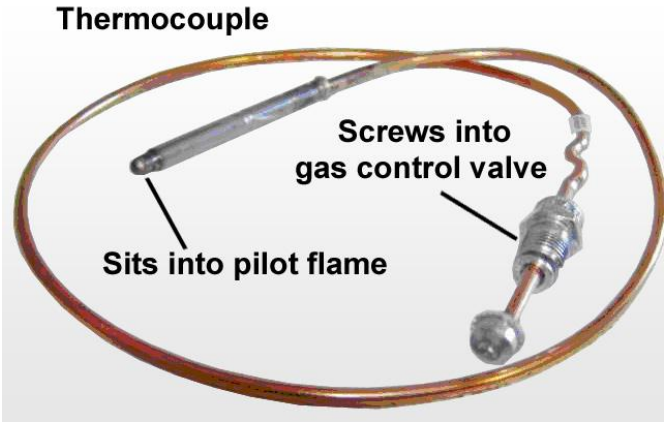
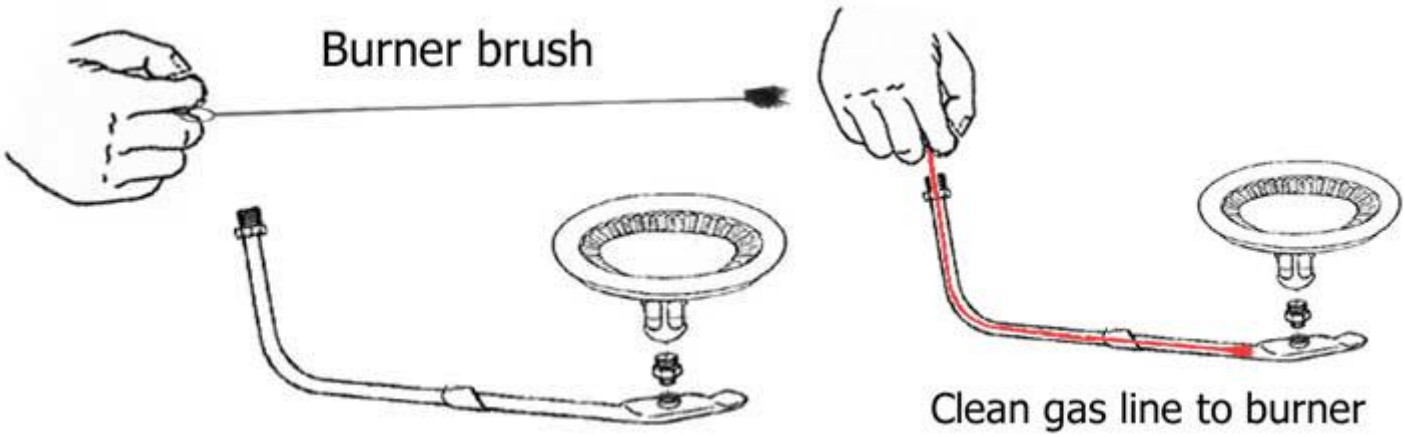


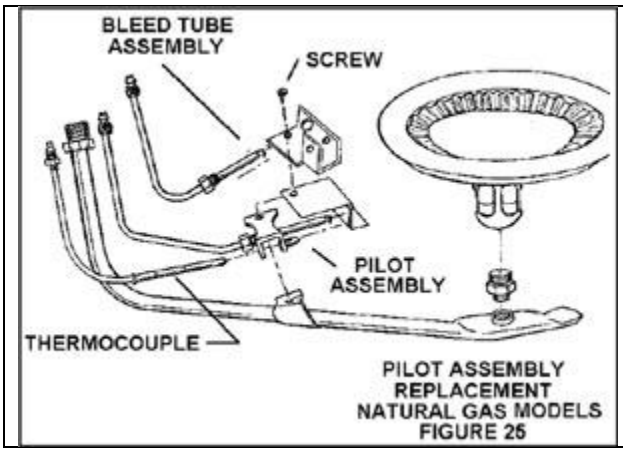
Fig 2 Typical Robertshaw Gas Thermostat/ Gas control valve. Read more about ECO below.

If Gas control valve senses temperatures over 180ºF, it will trip ECO fuse located inside gas control valve. Many water heaters require replacement of gas valve after thermal event. Other gas water heaters have re-settable thermal switch with wires leading to valve.

Threaded end of thermocouple screws into bottom of Gas control valve and other end sit in holder next to burner pilot light. End of thermocouple must be in the pilot flame. Heat from flame is converted into small electric current that signals Gas control to keep gas flowing. When thermocouple is defective. or if pilot flame goes out or if thermocouple has slipped out of the pilot flame, then Gas control turns off gas to pilot and shuts off gas to burner. When installing thermocouple, don't overtighten or it will crush the insulator and short out the 11 milivolts produced by thermopile. Use fingers to start threads. Rule of thumb is finger tight plus 1/4 turn adding another 1/8 turn if thermocouple is loose. Make sure not to cross thread thermocouple in Gas control valve.

USE burner brush to clean gas lines, and pilot tube.





CONTAMINANTS IN THE GAS PIPING MAY FOUL THE GAS CONTROL /THERMOSTAT CAUSING A MALFUNCTION, FIRE OR EXPLOSION. BE SURE ALL GAS PIPING IS CLEAN AND CLEAR ON THE INSIDE BEFORE ATTACHING THE GAS LINE.

WATER HEATER AND ANY OTHER GAS FUEL BURNING APPLIANCE MUST BE PROVIDED WITH ENOUGH FRESH AIR FOR PROPER VENTILATION OF THE FLUE GASES.

LP water heater: Manifold tube and burner are reverse thread

REMOVAL AND CLEANING
OF THE BURNER ASSEMBLY

***Clean burner

Disconnect thermocouple, pilot tube, bleed tube and manifold extension at the thermostat.
L.P. gas systems use reverse (lefthanded) threads on the manifold tube.
Grasp the manifold tube and push down slightly to free the manifold, pilot tube, bleed tube and thermocouple. Pull the burner out slightly to free it from the holding bracket. Tilt the burner to one side and remove it from the burner compartment.

Check the burner to see if it is dirty or clogged. The burner may be cleaned with soap and hot water. If a sooty condition exists, refer to your manual's Troubleshooting Chart

When re-connecting manifold extension and bleed tube and pilot tube, do NOT use thread sealants.Teflon tape is not needed.

Correct Flame
- ✓ Tip of Thermocouple or Thermopile is 3/8" to 1/2" into pilot flame.

Noisy, Lifting, Blowing Flame
- ✓ High Gas Pressure
- ✓ Wrong Pilot Orifice

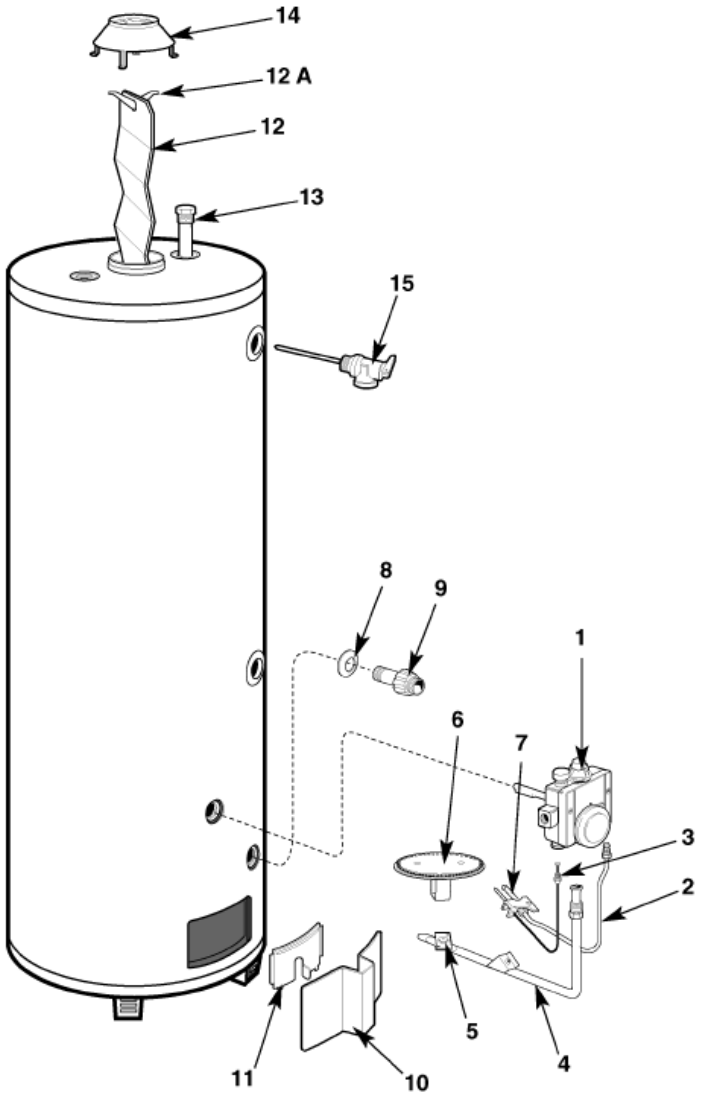
Lazy Yellow Flame
- ✓ Clogged Primary Air Opening
- ✓ Low Gas Pressure
- ✓ Clogged Pilot Orifice

Wavy Blue Flame
- ✓ Draft Condition at Pilot

Hard Sharp Flame
- ✓ High Gas Pressure
- ✓ Pilot Orifice Too Small

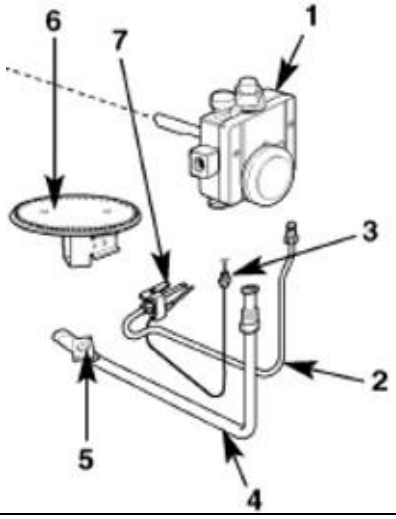
Small Blue Flame
- ✓ Wrong Pilot Orifice Size
- ✓ Low Gas Pressure
- ✓ Clogged Pilot Tube

Typical parts



1. Thermostat
2. Pilot Supply Tube
3. Thermocouple
4. Burner Supply Tube
5. Burner Orifice
6. Burner
7. Pilot Burner NG
8. Drain Valve Shroud
9. Drain Valve
10. Jacket Door
11. Inner Door
12. Flue Baffle
12A. Flue Baffle Hanger
13. Anode Rod
14. Draft
15. T&P Relief Valve

Fig 4



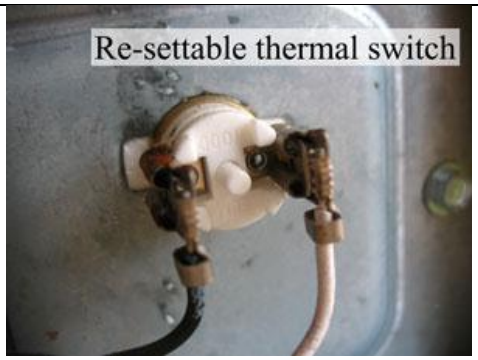
ECO/ energy cut off –or- High-Limit –or- Thermal cut off

Instruction manual will say if ECO is located inside Gas control. 'Single-use' means Gas control valve must be replaced after ECO is tripped Advisory says not to jumper across the wires on back of Gas control valve. Operating Gas control valve without ECO protection can cause water heater explosion due to run-away overheating and excessive pressure inside tank.

**** ECO: WATER TEMPERATURES IN EXCESS OF 180° F WILL CAUSE HIGH LIMIT CONTROL (ECO) TO OPEN AND SHUT OFF GAS SUPPLY TO UNIT. THE HIGH LIMIT CONTROL IS A SINGLE USE TYPE THAT WILL REQUIRE REPLACEMENT OF THERMOSTAT BEFORE THE BURNER CAN OPERATE.**

DO NOT BYPASS OR JUMPER THE ECO. THIS WILL VOID WARRANTY AND RELEASE MANUFACTURER FROM LIABILITY FOR ANY ACCIDENT RESULTING FROM ELIMINATING THE ECO FROM THE WATER HEATER CIRCUIT.

Whirlpool resettable thermal switch or ECO/energy-cut-off is located on combustion chamber door. Wires from ECO thermal switch connect to Gas control.
ECO can be located inside Gas control and also on combustion door. If Gas control ECO is tripped, then Gas control has to be replaced. ECO trips when temperatures reach more than 180ºF. The ECO protects water heater in event of failed thermostat, or failed Gas control valve, or overheating caused by dirty and poorly maintained burner



If ECO thermal switch is tripped, burner will not operate

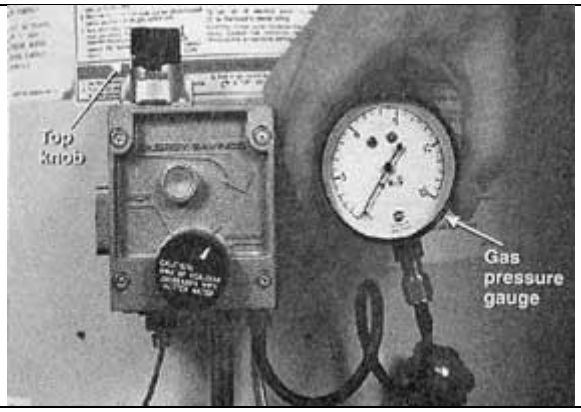
Trace amounts of chemical will damage gas water heater

If burner parts are rusted, pilot might not light.

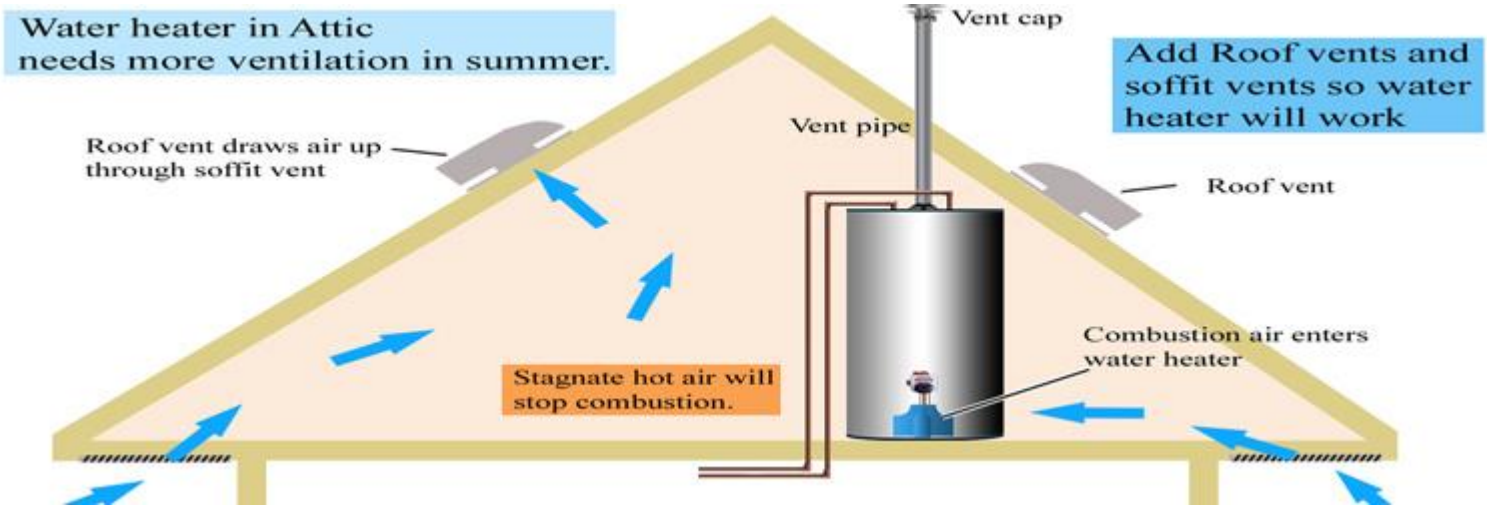
Combustion air must be free of acid-forming chemicals such as sulfur, fluorine, and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint and varnish removers, refrigerants, process chemicals and wax, and many other commercial and household products. When burned, vapors from these products form highly corrosive acid compounds. These products should not be stored near the water heater or air inlet.

http://waterheatertimer.org/How-to-repair-Rheem-FVIR.html

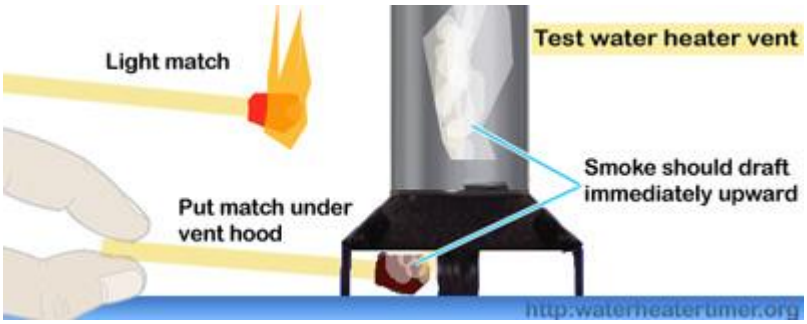
FV sensor or FVIR
Rheem FV sensor, or FVIR, trips and shuts off air supply to combustion chamber. FV event is caused when Flammable Vapors enter water heater. Tripped FV prevents flashover, fire and explosion inside house: Replace sensor kit.



Test gas pressure, bleed air out of gas line



Attics, basements, closets need adequate incoming air supply. Very hot air in attic will cause oxygen molecules to separate and no longer support pilot flame. Open doors and windows, and add vents to get air to water heater. Backdraft and tight house, furnace, fireplace, and other gas appliances that draw air etc, can combine with mechanical vent fans such as range hood, bathroom fans, to create negative pressure inside house that blows out pilot light.



Test vent draft.
If vent is not drafting, or has backdraft, then pilot will blow out or not keep burning.
If burner is rusted, check if condensation is running down inside the vent pipe.

NEGATIVE PRESSURE

Negative Pressure	Diagnosing pilot outage complaints requires an examination of the environment in which the heater is installed. Mechanical vent fans are the chief cause of negative pressure. If the house is too tight, more air will be exhausted from the structure than is being brought in from the outside, resulting in a negative pressure condition. Fireplaces, furnaces, wind, and thermal stacking within the house can also play a role in creating negative pressure conditions. Negative pressure can result from air being backdrafted through the water heater vent down into the combustion chamber, blowing out the pilot. This may happen randomly because it may be a particular combination of appliances which cause the condition.

Turn off all household vent fans and gas appliances to see if pilot will light.
Ventilate water heater location.
Raise height of outdoor vent termination. Trim limbs, move vent away from walls.
Check for backdraft blowing down vent.
Inspect combustion chamber for water dripping down vent.

Power vent models: install condensate tee so water is not dripping down.
Compare vertical and horizontal vent lengths with installation manual