

USSC
Bulletin 389
Vent-Free Appliances

Frequently Asked Questions

What are the responsibilities of a gas hearth installer?

- A.) The popularity of gas hearth products bears important responsibilities for the consumer. Improper installation or servicing of gas hearth products may lead to fires or gas leaks resulting in injury or loss of life. It is important that all gas appliances be installed by an experienced installation and service technician. Some things that the gas installer must do are:
- 1.) The gas installer must know all state and local codes which govern installation of gas piping, appliances, and venting, as well as checking to see that the appliance has been tested and certified by testing laboratories.
 - 2.) The gas installer must follow the manufacturer's installation and service instructions and use the parts and materials called for.
 - 3.) The gas installer must inform the owner of the appliance proper maintenance and operational procedures.

What are the requirements for installing a gas heater?

- A.) First, refer to the owner's manual and follow all installation instructions. There are, however, some basic rules that apply.
- 1.) Check and see that gas appliance and gas piping meets local codes.
 - 2.) Adequate fresh air must be supplied to the heaters (vent-free).
 - 3.) USSC recommends that all units be equipped with a drip leg and a manual shut off valve. Refer to the owner's manual.
 - 4.) The gas supply to the heater must be 5"-7" W.C. for natural gas (Equivalent to ¼ PSI) and 11"-14" W.C. for propane gas (Equivalent to ½ PSI).
 - 5.) When using LP gas heaters, an external regulator must be used to decrease the tank pressure to 11"-14" W.C.

What are the benefits of a vent-free heater?

- A.) There are several advantages of installing a vent-free gas heater. First, is the efficiency of the heater. Most vent-free heaters are 99.9% efficient. No heat is being lost through a chimney. Second, vent-free heaters are more economical. Chimney pipe is expensive, as is the labor to install a chimney. Also, because of the heater's maximum efficiency, all of your fuel is burned completely, without waste. Third, is the versatility of installation. Providing that there is an adequate fresh air source, a vent-free heater can be placed in a number of space limited installations where a chimney is not possible.

Are vent-free heaters legal in all 50 states?

- A.) Vent-free heaters now comprise over 50% of all U.S. gas room heaters sold. This is an increase in almost all areas of the country. There are still, however, a few states that do not allow vent-free products, due primarily to antiquated codes originally designed to prohibit the sale of unvented residential kerosene heaters. Hopefully, within a couple of years, legislation will be changed in those states.

What is the purpose of an ODS pilot assembly and how does it work?

- A.) An Oxygen Depletion Sensing pilot will automatically shut off the flow gas if the level of available oxygen falls from the normal 20.9% to 18%, which is still well above the safe level. At an 18% oxygen level the flame becomes unstable, moves off the thermocouple, collapsing the electric field of the attached electromagnet. A spring-loaded flap or valve automatically shuts off the gas supply, extinguishing the unit.

What effect does altitude have on the operation of a vent-free gas heater and the ODS pilot?

- A.) The American Gas Association notes that altitude is accounted for in the ANSI Standard (Z21.11.2) and has no negative effect on the safe operation of the unit. The pilot light can experience nuisance pilot light outage and heater can occur. The Public Service of Colorado, however, has tested and installed products up to 8200 ft. With little or no nuisance pilot light outage.

Is any amount of carbon dioxide produced while a vent-free heater is operating?

- A.) Yes, while the heater is in normal operation, trace amounts of carbon monoxide are present. Trace amounts of carbon monoxide are defined as .001% to .005% in the room level air measurement. No adverse health effects are known to result when exposed to these trace amounts of carbon monoxide.

Is it possible for a vent-free gas heater to produce unsafe levels of carbon monoxide when it has been properly installed?

- A.) No, proper installation requires that an adequate fresh air supply be present. When an adequate level of oxygen is present, an unsafe level of carbon monoxide cannot be produced.

How close can a gas stove be to a combustible wall?

- A.) The clearance to combustibles with a gas stove is not as great as with a wood stove, due in part to the lower temperatures of a gas product. Also, most gas heaters are designed to put in a more confined space than would be possible with a wood stove. Please refer to the owner's manual, always- as each stove or heater will have different clearances for safe operation.

Why should a carbon monoxide detector be used in cooperation with a gas burning appliance?

- A.) We believe that while our heaters are 100% safe, every precaution should be taken. Carbon monoxide is found in some quantity by every type of heating and cooking

appliance other than electricity. There are many other sources in homes today. Carbon monoxide detectors give advance warning whenever carbon monoxide levels increase to a level for concern.

What are some causes of a pilot outage?

A.) There are many things that can cause the pilot light to go out. There are steps that can be taken to determine its cause.

Check gas supply - make sure the gas is turned on!!!

- 1.) First check the manifold pressure. A lack of pressure will cause the pilot light to go out.
- 2.) If the pressure is correct, then check to see if the supply line is clogged. Dirt particles can clog the orifice, as well as spiders and other insects that are attracted by the smell of mercaptan. If it a new installation be sure that pipe dope hasn't gotten into the pilot orifice.

Mechanical Problems

- 1.) Does the pilot assembly light? If the pilot won't light, then there is either a problem with the piezo ignitor or the gas supply. If there is a spark, then the piezo ignitor is O.K. If there is gas reaching the ignitor, then there should be a flame.
- 2.) If the pilot assembly will light, but not stay lit, then the problem is probably with the thermocouple. When lighting the pilot, the control valve is by-passed, allowing a constant supply of gas to go directly to the pilot. The pilot flame heats the thermocouple, causing an electromagnetic charge that opens the valve to the main burner. If the pilot will not stay lit, then the thermocouple is not opening the valve. This can be caused by a defective valve or thermocouple, but these parts, because of stringent requirements, are very reliable. In most cases, the cause is a problem with the installation.
- 3.) If the pilot light stays lit with the burner before going out, then there are a few possible problems. If the heater is a vent-free model, then the oxygen level could be too low. This is by design as a safety feature on the ODS pilot assembly. If the heater is a vented model, then a probable cause is the safety spill switch. Both of these features are to protect from toxic smoke inhalation, and should not be altered in any way.

What can be done to adjust a yellow flame?

A.) A yellow flame is the result of an improper air-gas mixture. Two things can be done to correct this problem. The air shutter can be opened wider or the gas can be reduced. Another solution to this problem is that the orifice is not straight, or is being blocked by contaminants and it is injecting the gas at an angle. Adjustments of this nature must be made by qualified servicemen only.

What size tank do I need to install?

A.) Before purchasing or installing a propane appliance, you need to determine what the

total load is going to be. The total load is the sum of all gas usage in the installation. The tank size is going to be dependent on this total. When installing a tank, make an allowance for future installations. If you don't, an unnecessary expense could be incurred by adding a larger tank and increasing the pipe diameter for an increased gas flow.

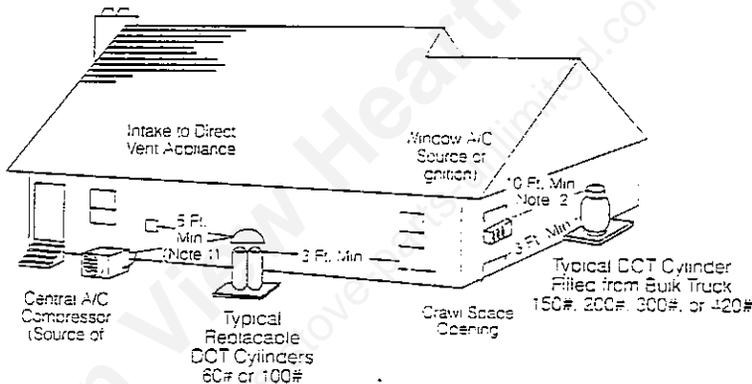
Where should the tank a propane tank be placed?

- A.) After the proper number of DOT cylinders or proper size of ASME storage container has been determined, care must be taken in selecting the most accessible, but "safety approved" site for their location. Consideration should be given to the customer's desires as to location of LP-gas containers- but precedence must be given to state and local regulations and NFPA 58.

Location of DOT Cylinders

From NFPA 58, Appendix G

Federal, state, and local ordinances and regulations should be observed at all times.

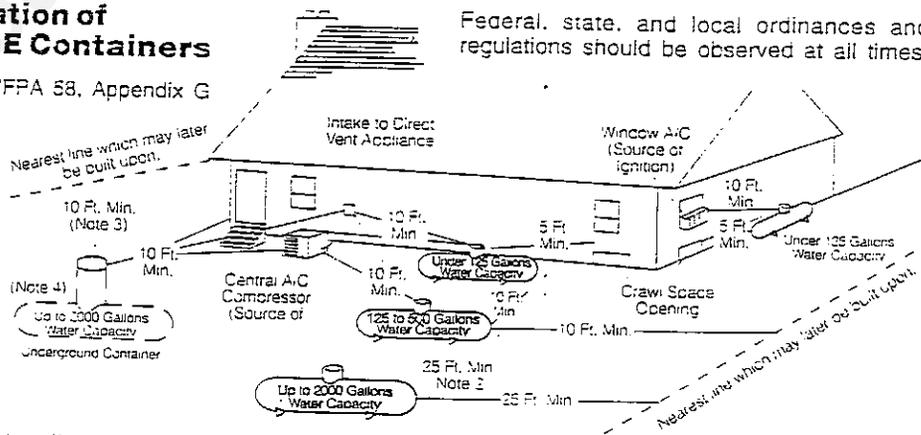


- Notes: 1) 5 foot minimum between relief valve discharge and external source of ignition (air conditioner), direct vent, or mechanical ventilation system (attic fan).
2) If the DOT cylinder is filled on-site from a bulk truck, the filling connection and vent valve must be at least 10 feet from any external source of ignition, direct vent, or mechanical ventilation system.

Location of ASME Containers

From NFPA 58, Appendix G

Federal, state, and local ordinances and regulations should be observed at all times.



Notes:

- 1) Regardless of its size, any ASME tank filled on-site must be located so that the filling connection and fixed liquid level gauge are at least 10 feet from external source of ignition (i.e. open flame, window A/C, compressor, etc.), intake to direct vented gas appliance or intake to a mechanical ventilation system.
- 2) May be reduced to 10 feet minimum for a single container of 1200 gallons water capacity or less if it is located at least 25 feet from any other LP-Gas container of more than 125 gallons water capacity.
- 3) Minimum distances from underground containers shall be measured from the relief valve and filling or level gauge vent connection at the container, except that no part of an underground container shall be less than 10 feet from a building or line of adjoining property which may be built upon.
- 4) Where the container may be subject to abrasive action or physical damage due to vehicular traffic or other causes, it must be either a) placed not less than 2 feet below grade; b) otherwise protected against such physical damage.

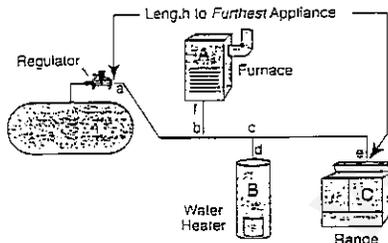
What type of piping should be used?

- A.) Black iron pipe or copper tubing should be used for installation of a propane gas appliance. When determining what size pipe should be used, the total gas input and the distance between the tank and the appliance should be considered.

Use the following simple method to assure the selection of the correct sizes of piping and tubing for LP-Gas vapor systems. Piping between first and second stage regulators is considered, as well as low pressure (inches water column) piping between second stage, single stage, or integral twin stage regulators and appliances.

Instructions:

- Determine the total gas demand for the system, by adding up the BTU/hr input from the appliance nameplates, and adding demand as appropriate for future appliances.
- For second, single or integral twin stage piping.
 - Measure length of piping required from outlet of regulator to the appliance *furthest away*. No other length is necessary to do the sizing.
 - Make a simple sketch of the piping, as shown.
 - Determine the capacity to be handled by each section of piping. For example, the capacity of the line between a and b must handle the total demand of appliances A, B and C; the capacity of the line from c to d must handle only appliance B, etc.

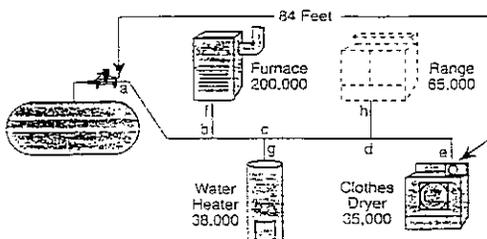


D. Using Table 4 select proper size of tubing or pipe for each section of piping, using values in BTU/hr for the length determined from step #2-A. If exact length is not on chart, use next longer length. *Do not use any other length* for this purpose! Simply select the size that shows at least as much capacity as needed for each piping section.

- For piping between first and second stage regulators.
 - For a simple system with only one second stage regulator, merely measure length of piping required between outlet of first stage regulator and inlet of second stage regulator. Select piping or tubing required from Table 1, 2 or 3.
 - For systems with multiple second stage regulators, measure length of piping required to reach the second stage regulator that is furthest away. Make a simple sketch, and size each leg of piping using Table 1, 2 or 3 using values shown in column corresponding to the length as measured above, same as when handling second stage piping.

Example 1.

Determine the sizes of piping or tubing required for the single-stage LP-Gas installation shown.



Total piping length = 84 feet (use table 4 @ 90 feet)

From a to b, demand = 200,000 + 38,000 + 65,000 + 35,000
= 338,000 BTU/hr, use 1" pipe.

From b to c, demand = 38,000 + 65,000 + 35,000

= 138,000 BTU/hr; use 3/4" pipe or 3/8" tubing.

From c to d, demand = 65,000 + 35,000

= 100,000 BTU/hr; use 1/2" pipe or 1/4" tubing.

From d to e, demand = 35,000 BTU/hr; use 1/2" pipe or 1/4" tubing.

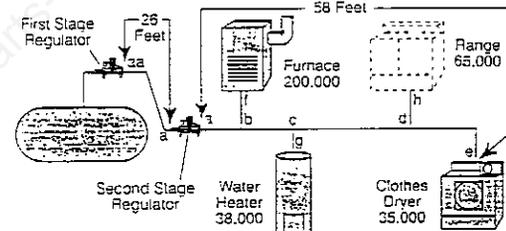
From b to f, demand = 200,000 BTU/hr; use 1" pipe.

From c to g, demand = 38,000 BTU/hr; use 1/2" pipe or 3/8" tubing.

From d to h, demand = 65,000 BTU/hr; use 1/2" pipe or 3/8" tubing.

Example 2.

Determine the sizes of piping or tubing required for the two-stage LP-Gas installation shown.



Total first stage piping length = 26 feet; first stage regulator setting is 10 PSIG (use Table 1 or 3, @ 30 feet)

From aa to a, demand = 338,000 BTU/hr; use 1/2" pipe, 1/2" tubing, or 1/2" T plastic pipe.

Total second stage piping length = 58 feet (use table 4, @ 60 feet)

From a to b, demand = 338,000 BTU/hr; use 1" pipe.

From b to c, demand = 138,000 BTU/hr; use 3/4" pipe or 3/8" tubing.

From c to d, demand = 100,000 BTU/hr; use 1/2" pipe or 1/4" tubing.

From d to e, demand = 35,000 BTU/hr; use 1/2" pipe or 1/4" tubing.

From b to f, demand = 200,000 BTU/hr; use 1" pipe.

From c to g, demand = 38,000 BTU/hr; use 1/2" pipe or 3/8" tubing.

From d to h, demand = 65,000 BTU/hr; use 1/2" pipe or 3/8" tubing.

I have been using a 100# tank to run my hot water heater. Why can't I use it to operate my heater as well?

- A.) The dispersal of propane from a tank lowers the contained pressure. This causes the liquid to boil in an effort to restore the pressure in the tank. The required "latent heat of vaporization" is surrendered by the liquid and causes the temperature of the liquid to drop as a result of the heat expended. The surface area of the tank that is in contact with the liquid is called the "wetted surface". The greater the wetted surface, the greater the capacity for vaporization. When a 100# tank is working on a water heater, there is enough vaporization function properly. When the heater is added, however, there is not a constant supply of gas vapor to operate both units. In addition, when outside temperatures decrease, vaporization is decreased.

What is the benefit of two stage regulation?

- A.) A two stage regulation system consists of a high pressure regulator at the tank to compensate for varied inlet pressures and a low pressure regulator at the house to supply gas to the appliances at a constant pressure. It is a good idea in any installation for a virtually trouble-free installation. Two stage regulation can greatly reduce freeze-ups and service calls resulting from expansion of gas. This is reduced because the gas expansion to 11" W.C. is divided into two steps, with less chilling effect at each regulator.

Trouble Shooting

No Spark

- A. Ignitor cable loose, pinched, wet, or dirty.
-Check the ignitor cable at connection. Make sure connection is tight and fully pressed onto ignitor electrode.
- B. Piezo ignitor nut loose.
-Make sure ignitor is tight.
- C. Ignitor electrode body cracked.
-Replace if cracked.
- D. Piezo ignitor worn out.
-If no spark is observed replaced piezo ignitor.

Ignitor sparks, but no pilot flame.

- A. Gas supply not turned on.
- B. Control knob not depressed while in pilot position
- C. Loose thermocouple
- D. Air in pilot line
-Purge air from gas lines.
- E. Dirty pilot assembly.

-Remove the wire clip from the bimetal strip on pilot. Blow out pilot assembly with compressed air (40 PSI max.)

F. Insufficient gas pressure.

-Check unit with manometer for proper gas pressure.

Thermostat not working.

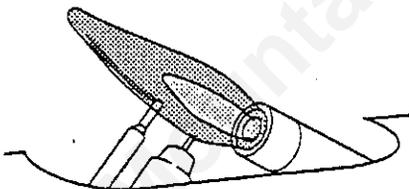
- A. Check to make sure thermostat bulb is properly mounted on back of heater.
- B. Remove bulb from bracket. Stick thermostat bulb in glasses of cold and then hot water to check the correct cycling.

Pilot ignites, but will not stay lit.

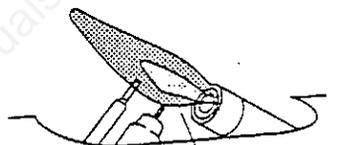
- A. Control knob not depressed long enough.
 - Be sure that the control knob is fully depressed for at least 30 seconds before releasing.
- B. Defective valve or thermocouple
 - Check to see that pilot flame is correct.
 - If pilot flame is normal, check control valve with BASO Millivolt Meter.
- C. Air in lines.
 - Continue holding down control knob. Repeat igniting operation until air is removed.

Be sure that the control knob is held down long enough to get the thermocouple hot. After lighting the pilot, hold the control knob down for 10 to 15 seconds before releasing.

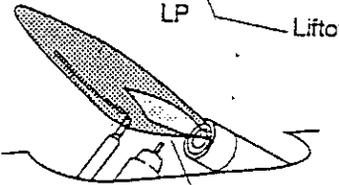
Check to be sure that the pilot flame pattern is correct



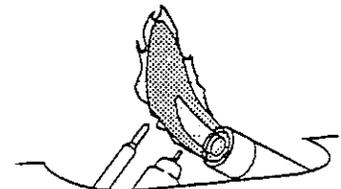
Correct LP Pilot Flame



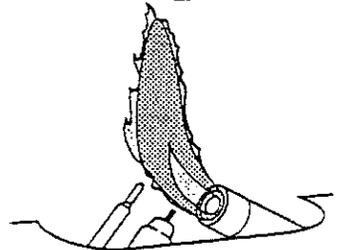
LP Liftoff



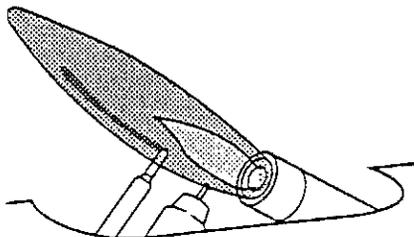
Natural Gas Thermocouple Liftoff



LP



Natural Gas Pilot Barrel Liftoff



Correct Natural Gas Pilot Flame

Be sure that strong or gusty drafts are not blowing on the heater. If necessary, the heater should be relocated to a more protected area.

Main burner does not light (pilot stays lit).

- A. Low inlet pressure
 - Check supply and line pressure and make sure it is adequate.
 - On LP models, be sure tank is not empty or nearly empty.
 - Check for frost on LP tank due to high usage.
 - Check for blocked injector.
- B. Burner orifice clogged.
 - Check burner orifice and remove obstruction with forced air.

Delayed ignition at main burner.

- A. Low gas pressure.
 - Check the inlet and manifold pressure for proper procedures.
- B. Blocked burner tube.
 - Check for restrictions due to dust, spiders, or debris. Remove with compressed air.

Backfiring during operation.

- A. Low pressure to burner (plaque).
 - Check gas pressure to main burner.
- B. Blocked burner tube.
 - Check for spider webs, debris, or dirt.
- C. Burner damaged.
 - Inspect the main burner to see if the tube is bent or damaged. Replace if necessary.

Smoke or odors.

- A. Oil or residue from manufacturing processes.
 - All heaters have an oil residue from manufacturing. Unit should be burned for approximately 10-12 hours to completely burn off all oils.
- B. Household chemicals
 - Some household chemicals such as paint, hair spray, varnish, or glues can produce unwanted odors when used around a heater that is under operation. Any foreign substance in the environment will cycle through the heater and burn, creating an odor.

Gas Odor

- A. Gas leak.
 - Test all fittings and gas connections for leaks.
- B. Defective control valve.
 - Visually check gas valve for defects.
- C. Dirt or other particles clogging gas lines.
 - Check inlet and manifold pressure for proper supply pressure. If flame is less than $\frac{1}{2}$ the height of the glass panel at the "high" setting, dirt or particles may be clogging the line between the valve and burner. Check the burner orifice and

clean if necessary.

Sooting

- A. Improper Installation
 - Make sure a qualified, licensed gas installer performs the work.
- B. Incorrect log placement.
 - Consult owner's manual and check the section on placing the logs.
- C. Air shutter
 - Adjust the air shutter to achieve complete combustion of fuel.

Installation

Gas Connection

- The gas supply line must be sized and installed to adequately supply gas to meet the demands of the heater without pressure loss.
- The supply system must include a manual shut-off valve, a union in the line and a plugged 1/8 inch NPT tap. The tap should be accessible for test gauge connections upstream of the gas supply connection to the heater.
- When using propane gas, an external regulator must be used. The regulator must reduce the incoming supply pressure to a maximum of 14" W.C.

