5. Non-vented and vented gas appliances

Overview

Purpose

A gas technician/fitter encounters many different gas appliances: some simple, some complex, some vented, and others non-vented. The purpose of each is to transfer heat for a particular purpose. This Chapter gives an overview of gas appliances commonly found in the industry.

Objectives

At the end of this Chapter, you will be able to:

- describe heat transfer methods;
- describe non-vented gas appliances; and
- describe vented gas appliances.

Terminology

Term	Abbreviation (symbol)	Definition
Conduction		Flow of heat through a substance by the transfer of heat energy from particle to particle
Convection		Movement of heat due to the movement of the heated body
Radiation		Transfer of energy through space, even through a vacuum

Heat transfer methods

Energy is neither creatable nor destroyable. However, you can move or transport it from one place to another in various ways. To understand how a heating or cooling system works, you must first understand the ways in which heat transfer (energy movement) occurs.

Heat transfer

Water always flows downhill, never uphill. In the same way, heat always flows in one direction, from hot to cold. When water flows downhill, the steeper the hill, the faster the water travels. Likewise, in the transfer of heat, the greater the temperature difference, the faster the heat flows.

3) Does the furnace fan continue to run if the high-limit switch opens the furnace control circuit?
   a) Yes
   b) No

4) What causes the contacts of a steam boiler operating pressuretrol to open?
   a) The water level in the boiler increases
   b) A rise in steam pressure
   c) The water level in the boiler decreases

5) What activates a flame roll-out switch?
   a) Spillage of flue products from the draft hood opening
   b) The opening of the high limit
   c) A rise in temperature

6) Match the following terms to their corresponding definitions:

a) Senses the operation of a circulating pump:	Flame roll-out switch
b) A water temperature sensing device that will shut off the burner (s) if the temperature exceeds the desired operating range of the boiler or water heater:	High limit pressure switch
c) Shuts off the burner(s) in the event that the pressure in a boiler exceeds its desired operating range:	Operating aquastat
d) Turns a steam boiler on and off to maintain a desired steam pressure:	Blocked vent shut off system (spill switch)
e) Turns a boiler or water heater on and off to maintain a desired water temperature:	Low water cut-off switch
f) Shuts the burner(s) off if the water level in a system falls below a desired point:	Pressure switch
g) Allows hot water or steam to escape from a system if the pressure exceeds a preset maximum value:	Operating pressure switch
h) Shuts down the burners in the event of a failure to vent flue products from the combustion chamber:	High temperature aquastat
i) Is used in a forced air furnace and has 2 functions: 1) turns the fan on and off in response to sensing heat in the combustion chamber; 2) shuts down the burners when combustion chamber temperature exceeds a preset value:	Pressure relief valve
j) Allows water to escape if temperature or pressure exceeds a preset value inside a hot water heater:	Combination high limit/fan control switch
k) Senses air movement using a paddle attached to a micro-switch:	Flow Switch
i) Shuts off the burners if the vent is totally blocked:	Temperature and pressure relief valve

Heat moves in three major ways:

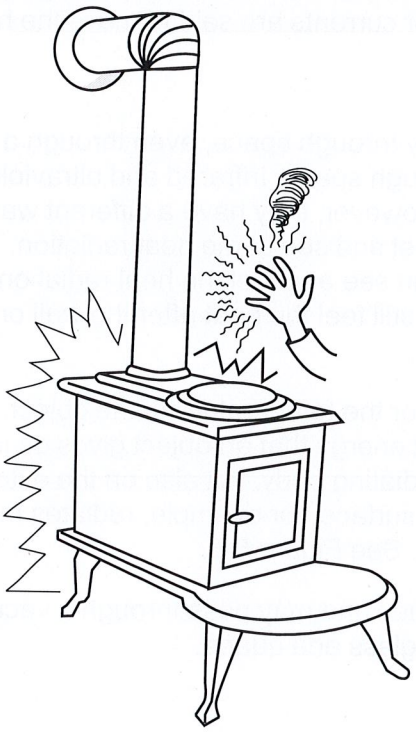
- conduction;
- convection; and
- radiation.

Conduction

Conduction is the flow of heat through a substance as heat energy transfers from particle to particle. As the particles with greater motion pass some of their energy to slower particles, heat energy flows from the warmer region to the colder region. This is why, when a rod is heated over an open flame, heat travels by conduction from the hot end to the cooler end.

Conduction heat transfer occurs not only within an object or substance, but between different substances that are in contact with one another. See Figure 5-1.

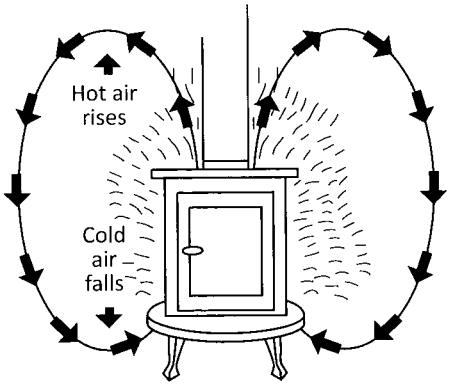
Figure 5-1
Transfer by contact–conduction



Convection

Convection is the movement of heat due to the movement of the heated body. In a convection heating system, something undergoes heating, then moves to the location to be heated, where the system gives off the heat. You can most easily do this with fluids (gases and liquids), because you can easily make them flow from one place to another to carry the heat. Air is a mixture of several gases and is therefore considered a fluid. As the air flows or moves, it carries heat from one place to another. See Figure 5-2.

Figure 5-2
Transfer by natural motion–convection



When a fluid undergoes heating, it expands and becomes lighter. If part of a fluid is cooler than another part, gravity pulls the cooler part earthward, displacing the lighter part of the fluid so that it rises. Convection movements or currents are said to move the heat.

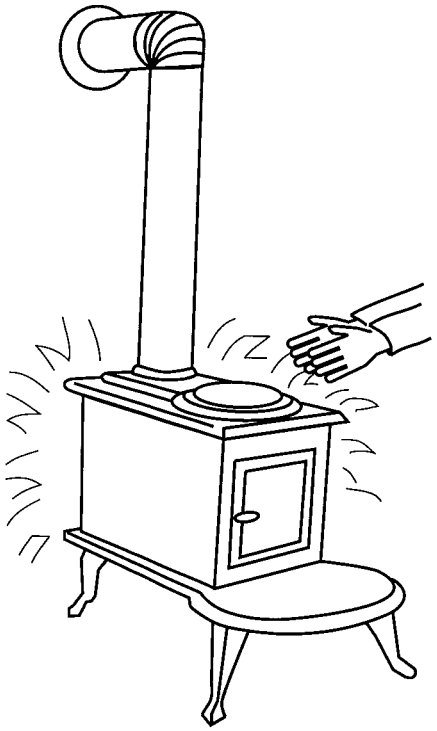
Radiation

Radiation is the transfer of energy through space, even through a vacuum. Light is a visible form of wave energy that radiates through space. Infrared and ultraviolet rays are next to visible light waves on the colour spectrum. However, they have a different wavelength. You can feel, but not see, their effects. You can also feel and see some heat radiation. The light from the sun is a good example. Another is when you can see and feel the heat radiation from a red-hot furnace wall or a white-hot piece of metal and can still feel the heat after the wall or the piece of metal cools and its heat no longer has visible effects.

All objects radiate heat. The higher the temperature of the object, the greater the quantity of heat it radiates. The amount of radiant energy that an object gives off in a Unit of time depends not only on the temperature of the radiating body, but also on the extent and type of its surface. At the same temperature, a rough dark surface, for example, radiates much more heat than another surface that is smooth and bright. See Figure 5-3.

Radiant heat travels in straight lines and may pass through a vacuum, air, some gases, some liquids, and a few solids such as glass and quartz.

Figure 5-3
Transfer through an intervening space–radiation



Non-vented gas appliances

Gas technicians/fitters commonly install and service the following non-vented gas appliances. You can find brief descriptions of their heat transfer methods, ignition system, burner control and here.

For more detailed information on each of the characteristics, refer to other Chapters in this Unit:

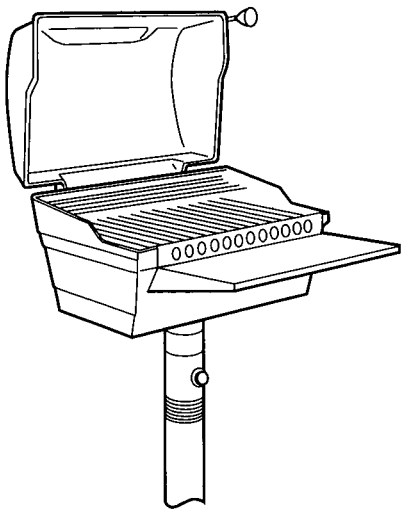
- Chapter *1. Venting*;
- Chapter *2. Operation and applications of various burners*;
- Chapter *3. Pilots and ignition systems*; and
- Chapter *4. Controls and safeties*.

Barbecue

Item	Description
Heat transfer	Although construction differs from one to another, gas barbecues (see Figure 5-4) cook mostly by infrared radiation and by convection. The supply of heat occurs in one of two ways: • from below the food by briquettes heated by a gas burner; or • from above the food by a gas burner of radiant material.

Item	Description
Ignition	You can light barbecues by hand or with piezo igniters (push-button quartz igniters).
Burner control	Burner control is typically through a manual control dial.
Safeties	Barbecues do not have safeties included; however, you must place them in a well-ventilated area as a safety measure.

Figure 5-4
Barbecue



Range

Cook Top

Refer to Clauses 7.32 and 7.33 of CSA B149.1 for the general installation requirements for residential (see Figure 5-5) and commercial ranges.

Item	Description
Heat transfer	Predominantly conduction
Ignition	You light older models with a match. Newer models, on the other hand, have automatic ignition (spark ignition).
Burner control	On most Units, gas flow through a manual valve controls the heat. Some Units have a thermostatically controlled burner whereby a device that contacts the bottom of the utensil being used senses the heat.
Safeties	There are no safeties.

Oven

Item	Description
Heat transfer	Natural or forced convection
Ignition	You manually light older models with a match. Newer models have a standing pilot or hot surface ignition.
Burner control	You turn the burner on and off manually. Controlling the gas flow to the burner involves the use of a temperature sensor and gas valve as thermostat.
Safeties	The safeties depend on the type of burner control.

Portable cook top and hot plate

Refer to Clause 7.29 of CSA B149.1 for the general installation requirements for portable cook tops (see Figure 5-6) and hot plates.

Item	Description
Heat transfer	Predominantly conduction
Ignition	Manual
Safeties	There are no safeties.

Figure 5-5
Residential range

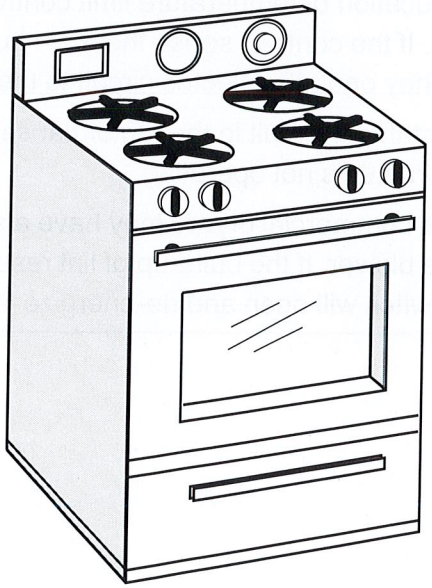
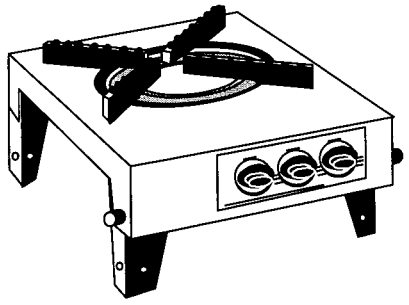


Figure 5-6
Portable cooktop

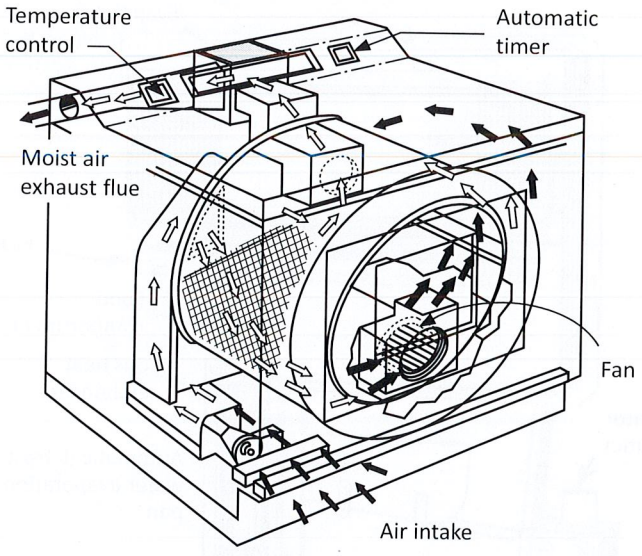


Clothes dryer

Refer to Clauses 7.4 and 7.5 of CSA B149.1 for the general installation requirements for residential (see Figure 5-7) and commercial clothes dryers. Gas dryers use a moisture exhaust duct that meets a separate set of code requirements from gas venting and as such is not considered a vented appliance.

Item	Description
Heat transfer	Forced convection
Ignition	Standing pilot, spark igniter, glow coil, or glow bar
Burner control	Thermostat sensing element senses exhaust temperatures. This cycles the burner on and off. Moisture sensor or timer controls the drying period.
Safeties	• The location of temperature limit controls is at strategic points in a dryer. If the controls sense the main burner compartment getting too hot, they open the electric circuit to the main gas valve. • A centrifugal circuit in the motor causes the main gas valve to close if the motor is not operating. • Large commercial dryers may have a sail switch located at the outlet of the blower. If the build-up of lint results in the reduction of air flow, the switch will open and de-energize the main gas valve.

Figure 5-7
Residential clothes dryer



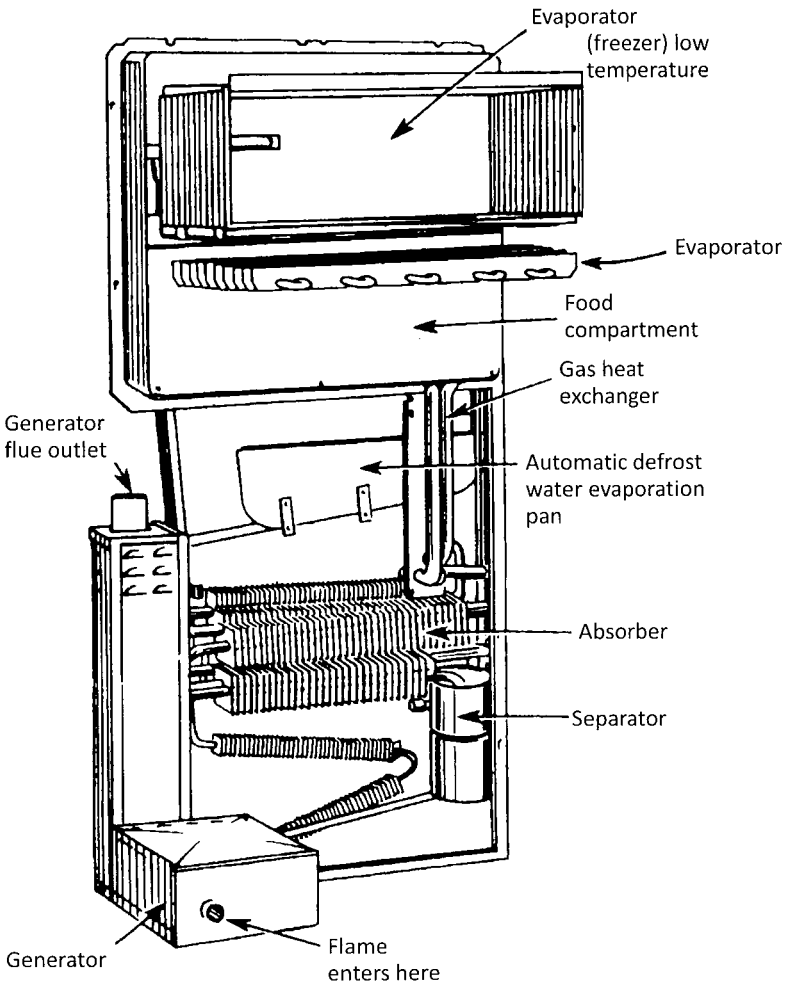
Refrigerator

Clause 7.34 of CSA B149.1 contains general installation requirements for refrigerators (see Figure 5-8).

Unvented gas refrigerators have been responsible for numerous CO exposures to occupants. These Units are older unvented models that regulators have subsequently banned for resale. Certified new Units both unvented and direct vented are available once again incorporating CO detectors interlocked to the pilot safety.

Item	Description
Heat transfer	Conduction
Ignition	Manual or piezo-electric
Burner control	Thermostat capillary type varies the amount of cooling by varying the amount of gas flow to the burner. The sensing bulb is attached to the evaporator of the refrigerator and directly controls a modulating valve.
Safeties	High temperature limit switch, interlocked with carbon monoxide (CO) detectors on new models

Figure 5-8
Refrigerator



Vented gas appliances

Forced warm-air furnace

Most furnaces in houses and small commercial buildings have a blower that circulates the conditioned air from a central area of the house, around the heat exchanger, and through the duct work to the rooms.

New gas furnaces in Canada are high-efficiency (89–96%) condensing furnaces. The high-efficiency furnaces use a plastic vent and are most often vented out the side wall.

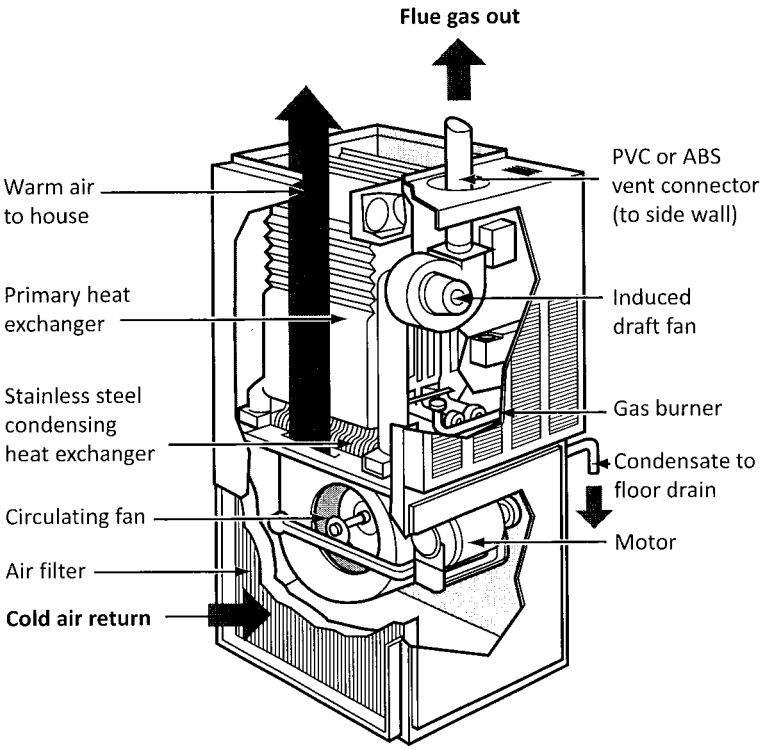
Multi-stage furnaces now have two or three levels of burner function, and an efficient, modulating circulation fan to move the heat into the house. They can provide additional heat when a quick temperature rise is required, such as in the morning when a house with a setback thermostat undergoes heating from 15 °C to 21 °C (59°F to 70°F).

Clauses 7.13 to 7.14 of CSA B149.1 contains general installation requirements for the various types of forced warm-air furnaces.

Item	Description
Venting	Natural draft, induced draft, or fan assist, depending on furnace design and manufacturing requirements
Venting material	B vent, BH vent, or direct vent
Heat transfer	Forced convection
Ignition	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	A thermostat mounted in the space being heated normally controls the automatic gas valve.
Safeties	• High temperature limit • Flame roll-out switch • Combustion air-proving switch • Door switch • Blocked vent shutoff system • Burner management system

There are several types of blower designs to accommodate different installation requirements. You can find both direct drive and belt driven blower assemblies in the field today.

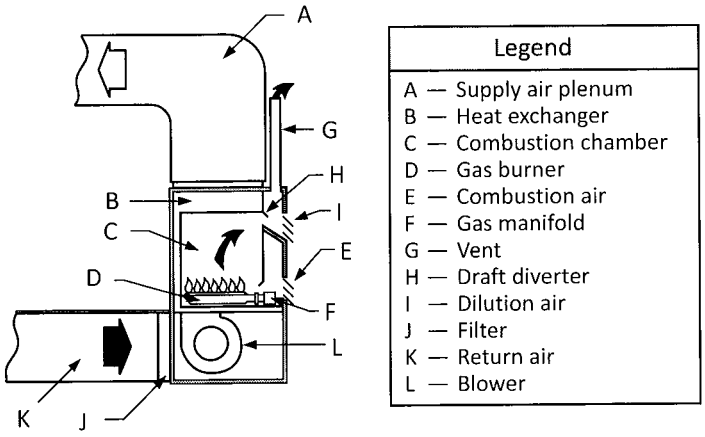
Figure 5-9
High-efficiency forced air furnace



Up-flow Units (high-boy)

Up-flow Units or high-boy Units have the blower under the heat exchanger with the air flow going upward (see Figure 5-10). You may install this type of furnace in closets or utility rooms.

Figure 5-10
Up-flow furnace



Down-flow Units

Down-flow Units have the blower above the heat exchanger with the air flow going downward (see Figure 5-11). You can find down-flow Units usually in trailers and mobile homes, as well as in single-storey buildings where the heating supply duct is installed in the crawl space.

Figure 5-11
Down-flow furnace

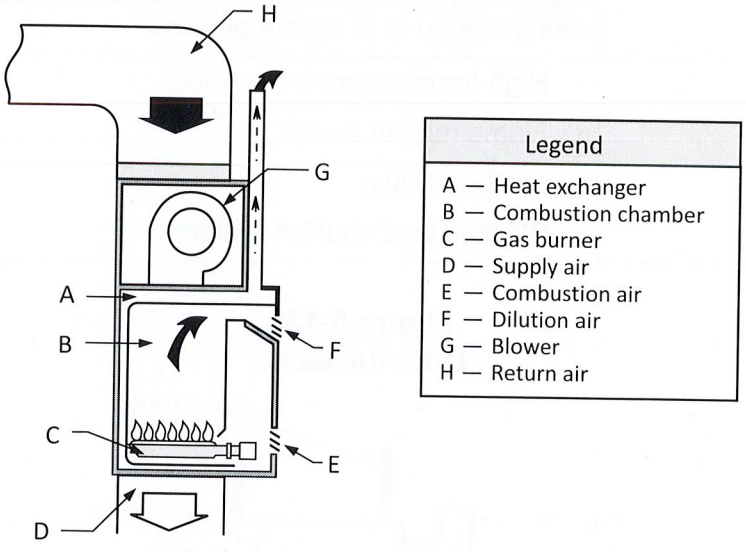
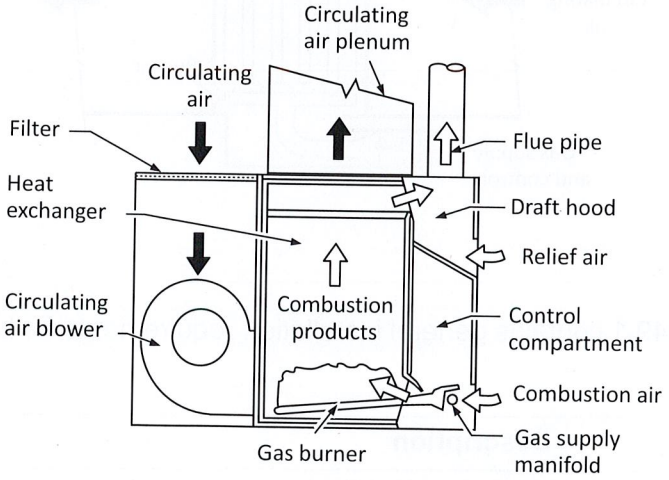


Figure 5-12
Low-boy furnace



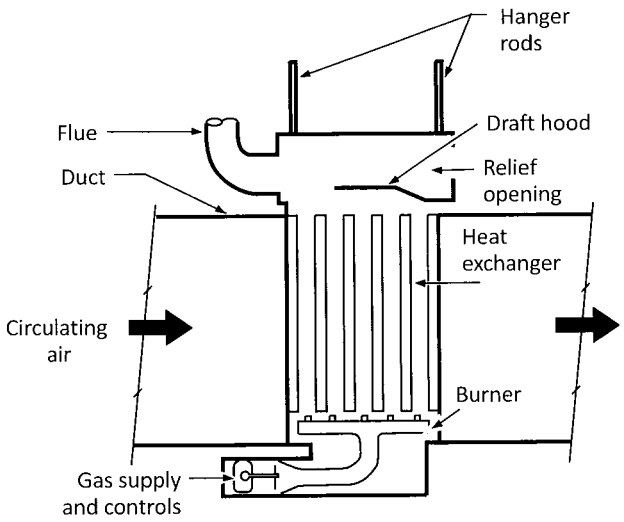
Duct furnace

You use duct furnaces (see Figure 5-13) in duct distribution systems where air moving equipment is supplied separately. In some applications, they function as indirect-fired make-up air heaters.

Clause 7.45 of CSA B149.1 contains general installation requirements for duct furnaces.

Item	Description
Heat transfer	Forced convection
Ignition	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	Burner that is under control of thermostat mounted in space being heated or in the supply duct
Safeties	• High-temperature limit switch • Flame roll-out switch • Air-flow switch • Blocked vent shut-off system

Figure 5-13
Duct furnace



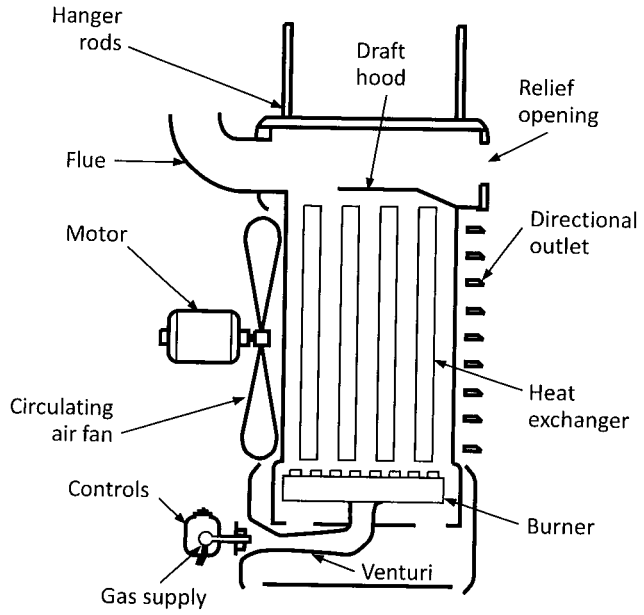
Unit heater

Clause 7.28 of CSA B149.1 contains general installation requirements for Unit heaters (see Figure 5-14).

Item	Description
Heat transfer	Forced convection
Ignition	Standing pilot, spark ignited pilot, direct spark ignition, hot surface ignition

Item	Description
Burner control	Manual switch or wall-mounted thermostat
Safeties	• High-temperature limit switch • Blocked vent shutoff system

Figure 5-14
Unit heater



Swimming pool heater

Most pool heaters include all necessary controls, including a pool temperature control and water that reduces condensation in the heater. You can find water heating appliances installed in the water circulation system of the pool at a point between the treatment stage and the pool.

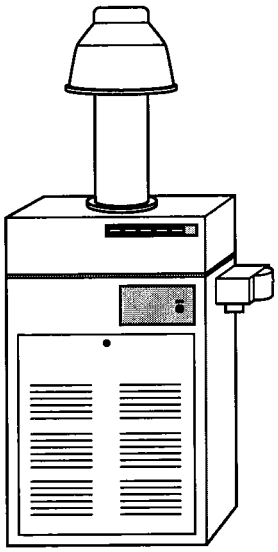
Swimming pool heaters may have problems not encountered with other water heaters and boilers because of the low water temperature at which they operate. In view of the condensation, which can be a problem, you should take extra care with respect to sizing, water flow, combustion air, and regular maintenance. It is imperative that the installer be familiar with the results of condensation and fully instruct the customer in detecting possible problems and their correction.

As a result of these ongoing maintenance issues and harsh operating environments, the installation of swimming pool heaters of the finned-tube type within a building that houses occupants is not allowed.

Clause 7.26 of CSA B149.1 contains general installation requirements for Pool Heaters (see Figure 5-15).

Item	Description
Heat transfer	Predominantly convection
Ignition	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	Aquastat
Safeties	High-temperature limit aquastat • Pool temperature control • Flow switch
Venting	Must comply with rating plate requirements

Figure 5-15
Swimming pool heater



Hot water boiler

Domestic and commercial space heating commonly employ hot water boilers. The boiler contains water, and a control system keeps the water at a preset temperature. A pump helps circulate the hot water through the heating system.

Clause 7.1 of CSA B149.1 contains general installation requirements for hot water boilers (see Figure 5-16).

Item	Description
Heat transfer	Convection and radiation
Ignition system	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition

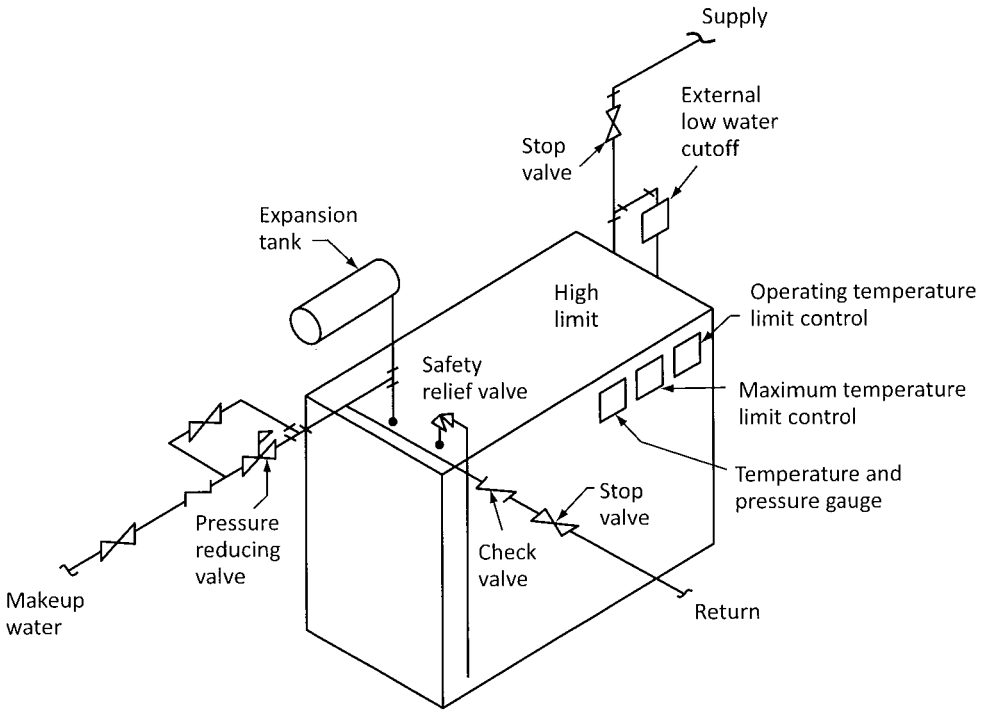
Safeties and burner control

Boiler safeties and controls (see Figure 5-16) are directly or indirectly connected to the boiler to regulate one of the following:

- firing of the boiler;
- boiler water temperature; and
- circulating pump.

Item	Description
Make-up water supply	Whenever boiler water pressure drops below a set point, you must supply make-up water.
Pressure reducing valve	The pressure reducing valve is set at a point below which boiler pressure must not drop. The valve allows the make-up water to enter and bring the boiler pressure back to the proper level.
Expansion tank	As the temperature of the water increases, the water expands. The expansion tank partially contains air, which compresses as the water expands and enters the expansion tank, allowing the system pressure to remain stable.
Stop valves	Stop valves help isolate the boiler from the system piping.
Operating temperature limit control	The operating temperature limit control monitors the water temperature and interlocks with the burner.
High temperature limit control	If the operating limit control fails, the high-limit control will shut the burner down. You must set the high-limit control at a higher temperature than the operating limit control.
Low water cut-off	A low water cut-off is required on hot water boilers when the input is in excess of 400 000 Btu/h (117 kW) or when the boiler is above the hot water circulating system. It interlocks with the burner to cause a shutdown if the water level drops below the set point.
Flow switch	Codes may require a flow switch on any copper fin tube type and/or low mass boiler, especially when the firing rate exceeds 400 000 Btu/h (117 kW). *Check your local code requirements.
Safety relief valve	If the pressure in the boiler rises above the set point, the safety relief valve will open and remain open until the pressure drops to a safe level.

Figure 5-16
Hot water boiler



All piping, safety requirements may not be shown. This illustration is for education purposes only. Adherence to local code requirements, as well as, manufacturer's certified instructions is essential to efficient and safe operation of any combustion appliance.

Steam boiler

It is uncommon to use steam boilers for domestic purposes. Generally, people use it to heat large spaces or for industrial processing.

Steam boilers partially contain water and the space at the top of boiler allows steam to accumulate (steam drum). The combustion control system monitors steam pressure.

Clause 7.1 of CSA B149.1 contains general installation requirements for steam boilers (see Figure 5-17).

Item	Description
Heat transfer	Convection and radiation
Ignition system	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition

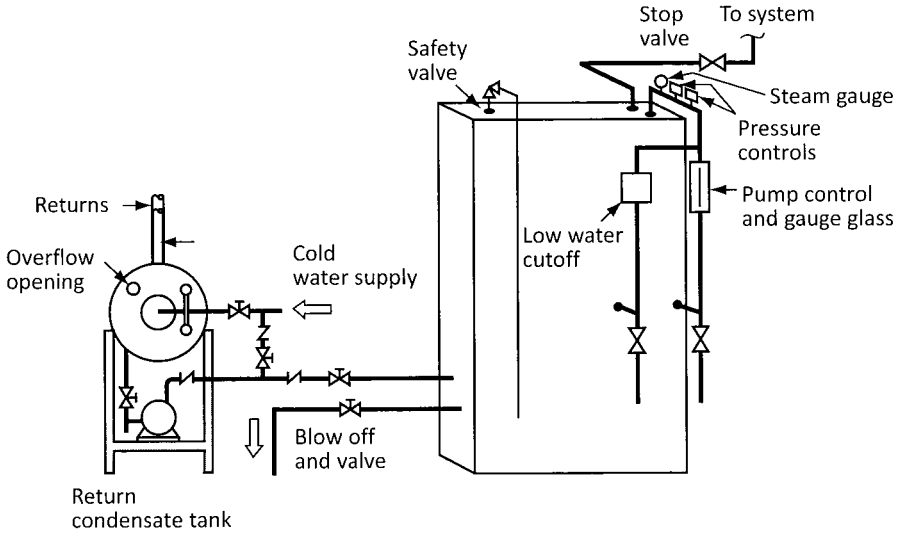
Safeties and burner control

Steam boiler system controls are directly or indirectly connected to the boiler to regulate one of the following:

- firing of the boiler;
- steam pressure; and
- feedwater.

Item	Description
Stop valve	Helps isolate components
Steam gauge	Registers steam pressure in the boiler
Operating pressuretrol	Controls steam pressure in the boiler, interlocks with the burner
High-limit pressuretrol	Set higher than the operating pressuretrol, interlocks with the burner to cause shutdown if the operating pressuretrol should fail
Pump control	Maintains proper water level in the boiler, which is visible through the gauge glass
Low water cut-off/Hartford Loop	Required on all steam boilers, interlocks with the burner, and causes shutdown if the water in the boiler drops below the required level A Hartford Loop is an arrangement of piping between a steam boiler's header and its gravity-return piping. The end of the header drops vertically below the boiler's waterline and connects into the bottom of the boiler. The pipe is termed the "equalizer" because it balances the pressure between the boiler's steam outlet and condensate-return inlet. The "wet" gravity return line, which returns the condensate from the system, rises from the floor to join the equalizer at a point about 2 in below the boiler's lowest operating water line. The piping arrangement is not fail-safe, but it is an improvement over the old way of returning condensate directly into the bottom of the boiler. A low water cut-off should protect the boiler against a sudden loss of water, but with a gravity-return system, a Hartford Loop is a cost-effective method to back up a low-water cut-off should a return rupture and water suddenly leave the boiler.
Safety valve	Opens and remains open until the pressure drops to a safe level if the pressure in the boiler rises above the set point
Check valve	Allows flow in only one direction, required on the condensate return line to the boiler.
Return tank	Condensate from the piping system returns to the tank and is fed to the boiler via the pump.
Feedwater pump	Supplies water to the boiler as required

Figure 5-17
Steam boiler valves and controls



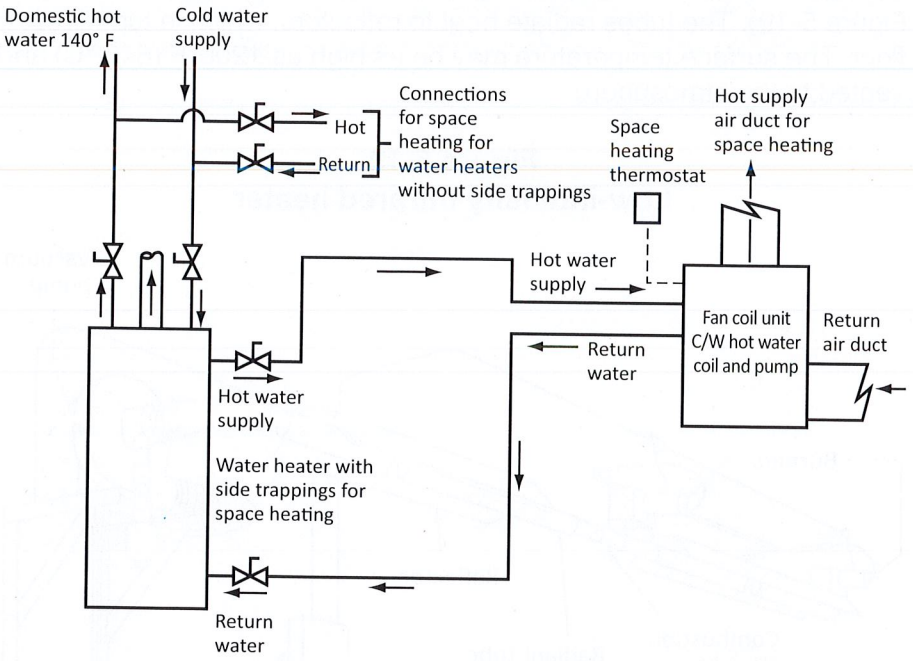
All piping, safety requirements may not be shown. This illustration is for education purposes only. Adherence to local code requirements, as well as, manufacturer's certified instructions is essential to efficient and safe operation of any combustion appliance.

Combination Unit

A combination Unit (see Figure 5-18) is a hot water heater that supplies water for domestic use, as well as a fan coil Unit that heats air for space heating. More elaborate systems can also supply hot water for in-floor radiant space heating.

Item	Description
Heat transfer	Conduction, convection, or radiation
Ignition system	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	Aquastat thermostat
Safeties	• High limit aquastat • Temperature pressure relief valves • All components must have approval for potable water.

Figure 5-18
Combination fan coil Unit with storage-type water heater



All piping, safety requirements may not be shown. This illustration is for education purposes only. Adherence to local code requirements, as well as, manufacturer's certified instructions is essential to efficient and safe operation of any combustion appliance.

Infrared heater

An open flame can produce infrared energy. However, modern infrared systems use burning gas to heat a radiating surface. (These heated surfaces are better radiators than naked flames.) The radiating surfaces undergo heating by direct flame contact or with the products of combustion.

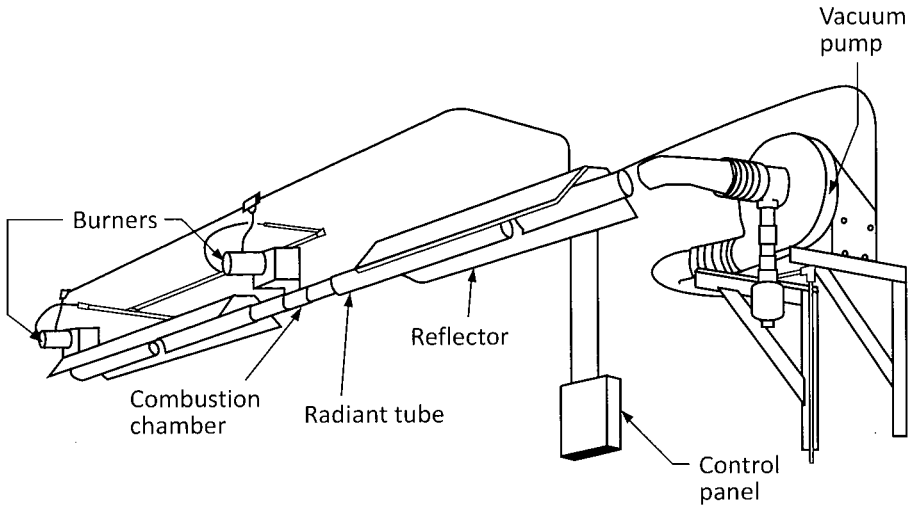
Clause 7.23 of CSA B149.1 contains general installation requirements for infrared heaters, which people primarily use for commercial or industrial purposes.

Item	Description
Heat transfer	Predominantly radiation
Ignition	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	Thermostat
Safeties	• High-temperature limit switch • Air proving switch for fan-operated system

Low-intensity infrared heater

In low-intensity infrared heaters, combustion occurs in tubes or panels that are made of metal or ceramic (see Figure 5-19). The tubes radiate heat to reflectors, which in turn direct the heat source to the floor. The surface temperature may be as high as 1200°F (648 °C) and the Units are generally vented to the atmosphere.

Figure 5-19
Low-intensity infrared heater

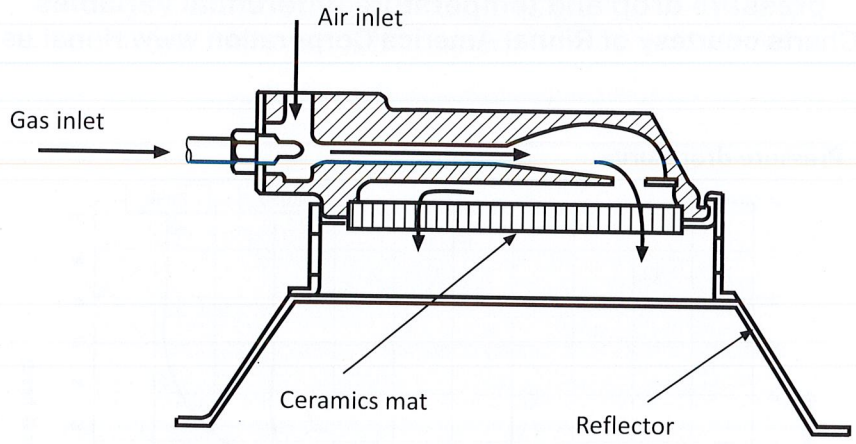


High-intensity infrared heater

High-intensity infrared heaters (often called "surface combustion infrared heaters") are made of porous ceramics, drilled port ceramics, stainless steel, or a metallic screen (see Figure 5-20). A combustible mixture of gas and air enters the enclosure and flows through the refractory material, at which point the gas ignites. Since the gas evenly spreads on the exposed surface, the flame is quite steady.

The surface temperature may rise as high as 1800°F (982 °C). To reach these high temperatures, you may use an atmospheric burner if the porosity is suitable; if not, you must use a power burner.

Figure 5-20
High-intensity infrared heater



You must not connect high-intensity infrared heaters to a vent. They must, however, be in a well-ventilated area.

Water heaters

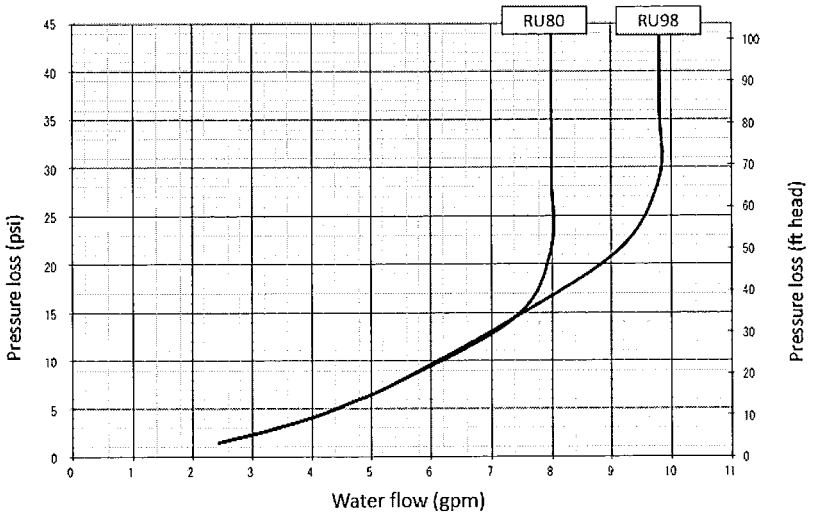
A gas water heater heats water for cooking, dishwashing, clothes washing, lavatories, baths, and showers. It does not heat water for space or central heating.

There are two common ways to heat the water: instantaneously (see Figure 5-21), as water is needed, and stored in a tank (see Figure 5-22) at constant temperature.

Tankless water heaters can provide an instant, endless supply of hot water within their net capacity and operating conditions. Though these Units modulate, their net output firing rate capabilities and the temperature differential between the incoming water temperature and their set output temperature (see Chart 5-1) determine their minimum and maximum GPM yield. Pressure drop through these Units increases with flow rate.

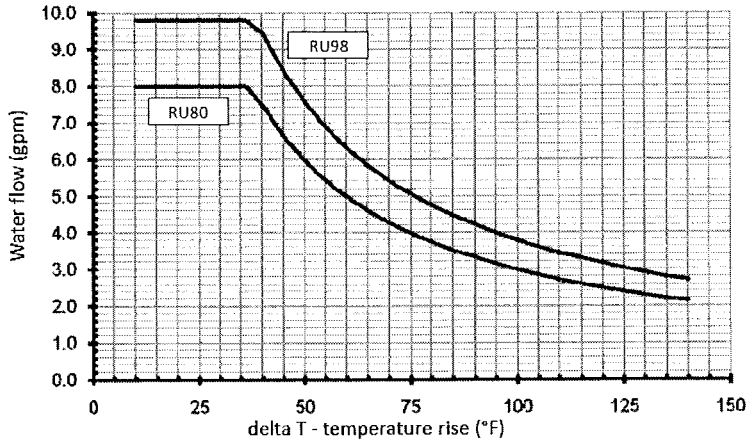
Chart 5-1
Maximum GPM yield charts for specific tankless water heater models based on pressure drop and temperature differential variables
Charts courtesy of Rinnai America Corporation www.rinnai.us

Pressure drop curve



NOTICE The chart below only applies to incoming water temperatures of 70°F (21 °C) or less. For incoming water temperatures greater than 70°F (21 °C) please contact Rinnai.

Outlet flow data



KB series manual 27

They typically have substantially higher firing rates than tank-type hot water heaters; therefore, they have far better recovery rates. Since these systems function on an on-demand basis, they don't require a holding tank to store pre-warmed water. Having no storage or holding reserve means that tankless water heaters have a life span that's potentially twice as long as traditional systems, because the risk of rust and corrosion may significantly drop with proper maintenance.

Careful adherence to the manufacturer's installation requirements for these Units is essential to their proper functionality and is the responsibility of the installer.

Figure 5-21
Instantaneous water heater

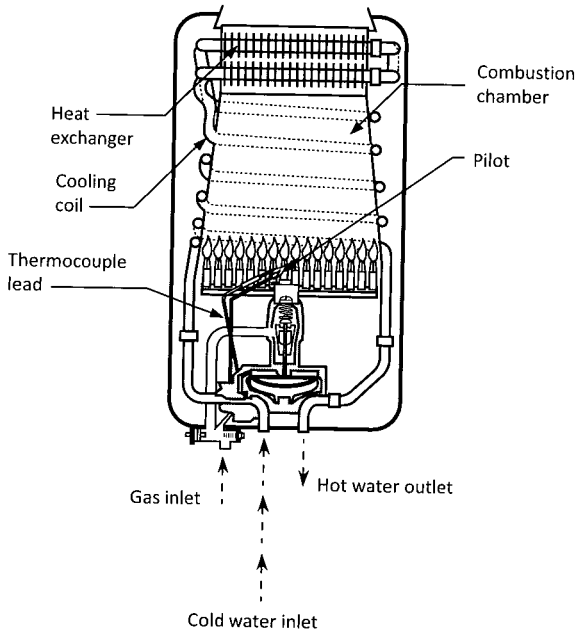


Figure 5-22 shows a storage-type hot water heater. This Unit is typical, however, limited in its recovery due to significantly lower firing rates. Its advantage over tankless type water heaters is its initial capacity and negligible pressure drop at high flow rates.

Gas technicians/fitters often get questions on their opinion regarding comparisons of tankless versus tank-type water heaters; however, there may not always be a clear "best choice".

Through an analysis of the potential system variables, such as potential GPM requirements, water hardness, and output/input temperatures, potential changes to gas/potable pipe sizing and supply water pressure help advise a customer of the advantages/disadvantages of both.

You must take application and site conditions into consideration.

Figure 5-22
Water heater tank

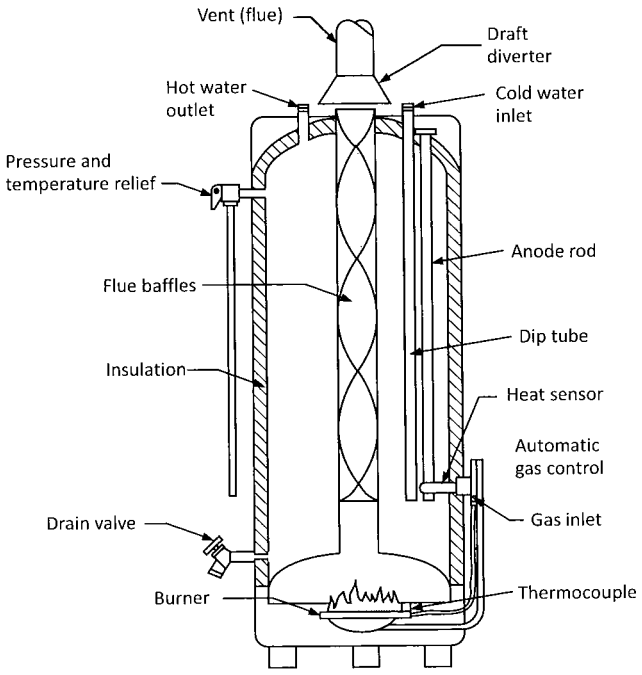


Figure 5-23 shows another version of a storage water heater where one tank houses water heating and a larger tank stores the water. Gravity or a circulating pump helps circulate the water is circulated through the heater. This system allows storage of large amounts of water for intermittent draw and uses a smaller heating tank. Additionally, the heating tank can supply water that is of a different temperature from that in the large storage tank.

Clause 7.27 of CSA B149.1 contains general installation requirements for water heaters.

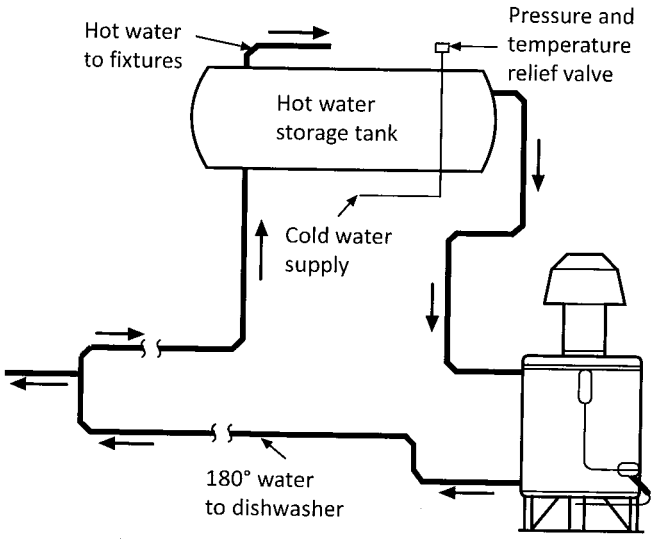
Item	Description
Heat transfer	Conduction
Ignition	Standing pilot, spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	• Aquastat • Non-electric valves
Safeties	• Temperature and pressure relief valves • High-limit aquastat • FVIR design

FVIR water heater design

Flammable Vapor Ignition Resistance (FVIR) is a technology developed for gas-fired water heaters that resists ignition of flammable vapours that may occur outside and near a water heater

as a result of the mishandling of flammable products. This helps guard against such an incident and reduce the risk of the water heater becoming a source of ignition.

Figure 5-23
Circulating water heating system (a bypass should be shown)

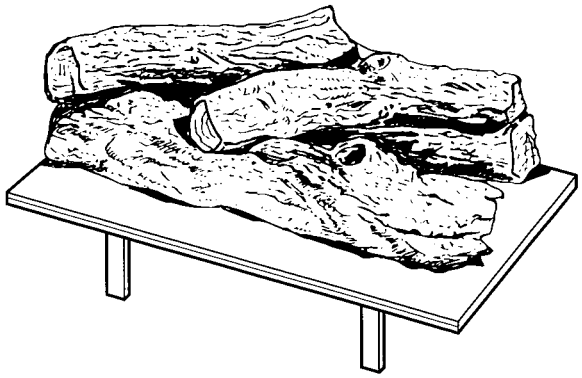


Decorative gas appliances

Clause 7.25 of CSA B149.1 contains general installation requirements for decorative gas appliances such as gas logs. See Figure 5-24.

Item	Description
Heat transfer	Predominantly radiation
Ignition	Standing pilot
Burner control	None
Safeties	None
Venting	Chimney, chimney liner, and type B vent

Figure 5-24
Gas logs



Vented gas fireplace

Vented gas fireplaces (previously called decorative gas appliances) include fireplace inserts (see Figure 5-25), free-standing stoves (see Figure 5-26), and zero-clearance Units. Clause 7.25 of CSA B149.1 contains general installation requirements for decorative gas appliances, including vented gas fireplaces.

Item	Description
Heat transfer	Convection, radiation
Ignition	Standing pilot, piezo igniter, hot surface ignition
Burner control	Thermostat or manual switch
Safeties	Blocked vent safety shut-off switch
Venting	Direct vent, Type B vent, flexible liners

Figure 5-25
Fireplace insert

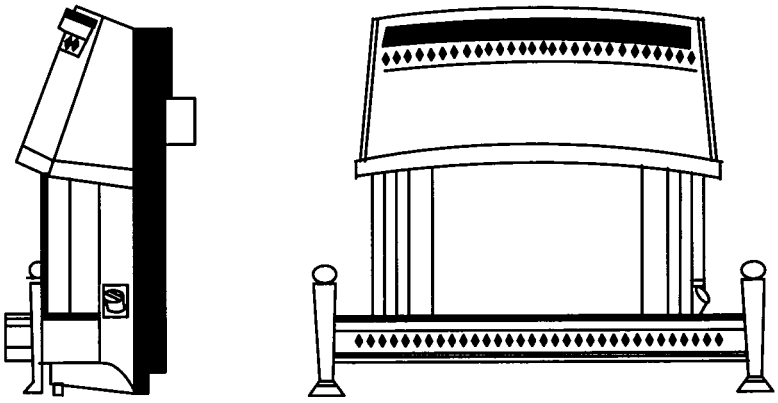
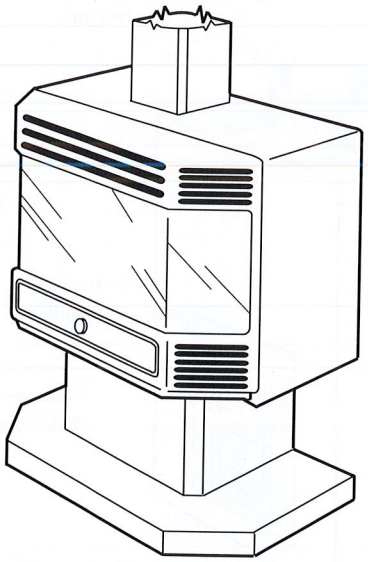


Figure 5-26
Free-standing stove



Various heaters

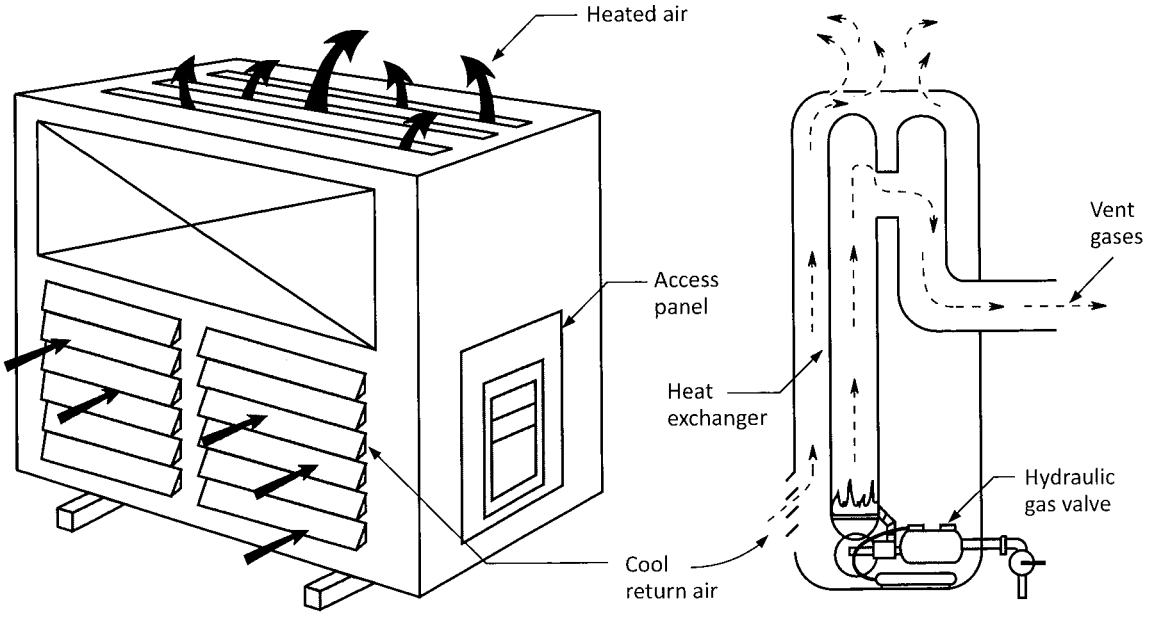
Clauses 7.17 and 7.24 of CSA B149.1 contains general installation requirements for space-heaters, recessed wall furnaces, and baseboard heaters.

Room space-heater

The room space-heater is a free-standing, self-contained Unit (see Figure 5-27) that is installed in the room where heat is necessary. Room heaters must be vented to the outside atmosphere and must be under thermostatic control. The venting system can be either gravity or forced-air (fan assisted).

Item	Description
Heat transfer	Convection, radiation
Ignition	Standing pilot and spark igniter
Burner control	Thermostat or manual switch
Safeties	High-temperature limit switch
Venting	Direct vent, Type B vent

Figure 5-27
Free-standing room space heater

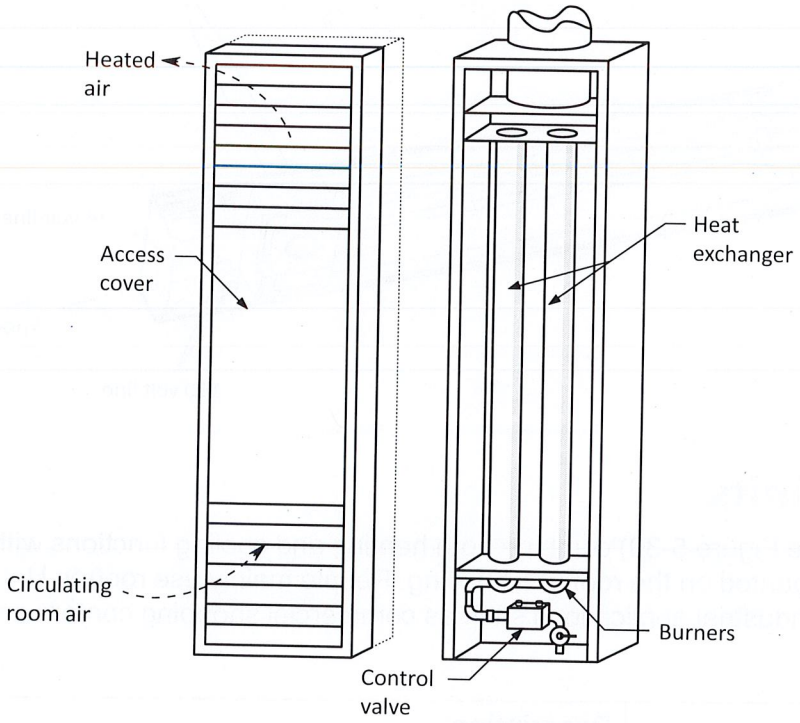


Recessed wall furnace

The recessed wall furnace (see Figure 5-28) takes up less space and is easier to install than other room heaters. (Wall furnaces were once recessed into the wall between the wall studs, but now they mount directly on the wall.) They are self-contained and available with or without a fan. You can find these appliances in small houses, room additions, garages, cabins, or motel rooms.

Item	Description
Heat transfer	Conduction
Ignition	Standing pilot, spark-ignited pilot, direct spark ignition and hot surface ignition
Burner control	Thermostat
Safeties	High-temperature limit switch
Venting	Type BW vent

Figure 5-28
Recessed wall furnace

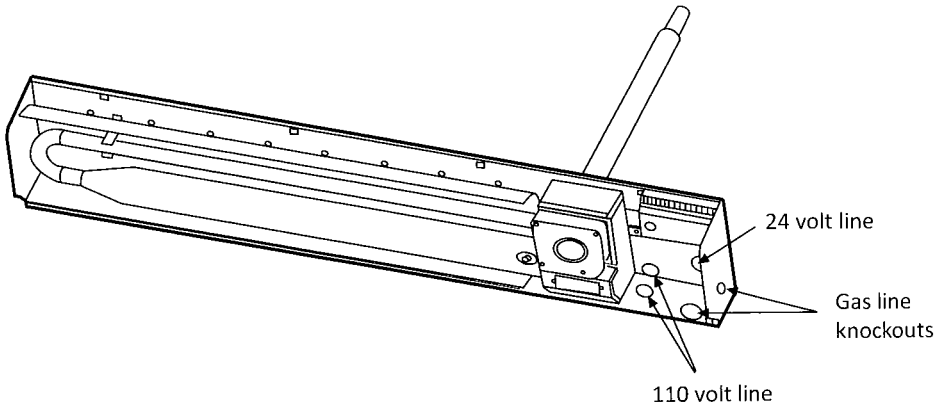


Baseboard heater

Baseboard heaters (see Figure 5-29) operate independently from other sources of heat. They can therefore be installed as required throughout a building. They are usually vented through an outside wall, rather than through the ceiling. This is a low input heating appliance that heats an area within a room.

Item	Description
Heat transfer	Conduction, convection
Ignition	Standing pilot, spark igniter pilot, direct spark ignition, hot surface ignition
Burner control	Manual switch or thermostat
Safeties	High temperature limit switch
Venting	Direct vent

Figure 5-29
Baseboard heater

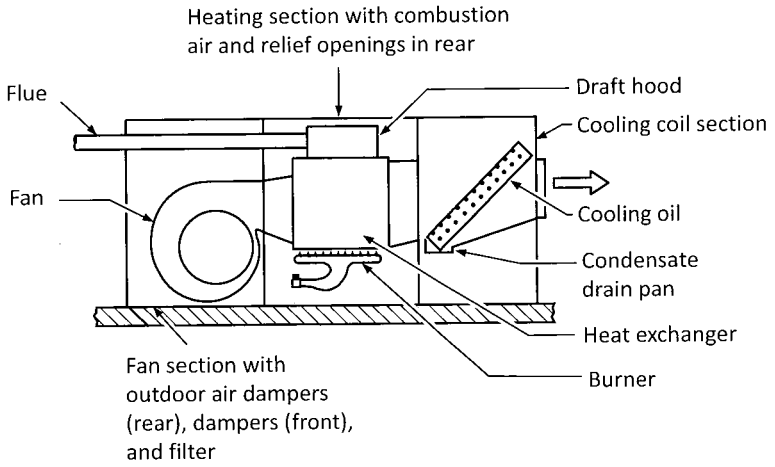


Rooftop Units

Rooftop Units (see Figure 5-30) combine both heating and cooling functions within a self-contained Unit mounted on the roof of a building. People mainly use rooftop Units for low-rise commercial and industrial applications such as commercial shopping centers and industrial parks.

Item	Description
Heat transfer	Conduction
Ignition	Spark-ignited pilot, direct spark ignition, hot surface ignition
Burner control	Thermostat
Safeties	High-temperature limit switch, gas pressure, and mercury pilot proving switches

Figure 5-30
Rooftop heating/cooling Unit

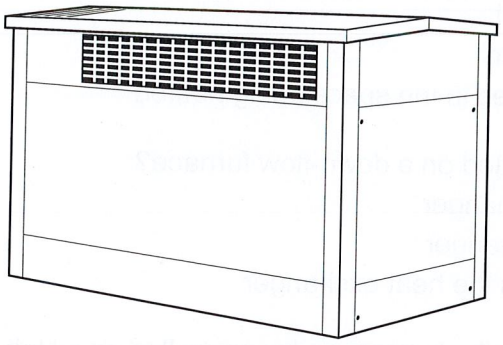


Generators

You can also install home generator systems to run on your home's natural gas line or propane supply. When a power failure occurs, the electric load automatically transfers to the generator set.

Upon restoration of the commercial power service, the electric load transfers back to the utility line. Because this process is completely automatic, there is the assurance of a ready supply of electric power for lighting, heating, air conditioning, and other various applications.

Figure 5-31
Gas-fired residential generator



Most appliance manufacturers offer training on their products or appliances. In some cases, validation of warranties may not be possible for equipment that a licensed, factory trained gas technician/fitter has not installed and/or initiated. Therefore, it is in every gas technician's best interest to continuously update their skills with training made available, as this will provide further employability and added value to your customers.

*It is special to note that connections made to gas appliances, including potable, hydronic, refrigerant, duct work, and electrical connections that exceed the essential components affecting the safe operation of the appliance, though potentially not mentioned within the Gas Code, must meet local provincial and municipal code requirements and may fall outside a gas technician's/fitter's scope of practice. It is the responsibility of the gas technician/fitter to comply with all codes as well as their local trade regulations.

Assignment Questions – Chapter 5

1) Which of the following is **not** a way in which heat is transferred?
   a) Vibration
   b) Conduction
   c) Radiation
   d) Convection

2) In which direction does heat energy flow?
   a) It flows from cold to warm
   b) It flows from warm to cold

3) What happens when a fluid is heated?
   a) It expands and becomes lighter
   b) It reduces volume.
   c) It boils

4) What controls the drying period of a gas-fired clothes dryer?
   a) The thermostat
   b) Moisture sensor or timer
   c) The high limit

5) What normally controls the automatic gas valve found on a forced warm-air furnace?
   a) The high limit control
   b) The air circulating fan
   c) A thermostat mounted in the space being heated

6) Where is the blower located on a down-flow furnace?
   a) Above the heat exchanger
   b) Below the heat exchanger
   c) At the same level as the heat exchanger

7) Name two ways in which the burner can be controlled on a Unit heater.
   a) Opening a window, manual shut off valve on the gas line
   b) A wall-mounted thermostat, manual switch

8) What factor must be considered when installing swimming pool heaters that would not be a concern with a hot-water space-heating boiler?
   a) High flow rate
   b) Low water temperature
   c) Thermostat location

9) Which of the following conditions are not regulated in a hot water boiler?
   a) Firing of the boiler
   b) Boiler water temperature
   c) Venting pressure
   d) Circulating pump

10) Which type of water heating system can be used for both domestic hot water supply and space heating?
   a) Combination Unit
   b) Any power vented water heater.
   c) Fin-type boiler