11) How is the heat directed to the floor in a low-intensity infrared heater?
    a) By the use of ceiling fan
    b) Through convection
    c) The tubes radiate heat to the reflectors which in turn direct the heat to the floor

12) What three types of gas-fired Units are used to heat a single room or other small areas?
    a) Room space heaters, Wall furnace, Baseboard heater
    b) Room space heaters, Steam boiler, Baseboard heater
    c) Baseboard heater, Room space heater, Infrared heater

13) Indicate True or False:
    Many gas-fired rooftop Units provide both heating and cooling functions.
    a) True
    b) False

6. Requirements for converting an appliance between propane and natural gas

Overview

Purpose

Previous materials have reviewed and compared natural gas and propane as fuel gases. While there are many similarities between the gases and the outward appearance and operation of appliances fired on the two gases, taking important differences such as specific gravity and calorific value into consideration is a must when converting from one fuel to the other. It is the responsibility of the gas technician/fitter who is making the conversion to ensure it is done in a safe manner, following all manufacturers' instructions and in accordance with gas code requirements.

Objectives

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

- describe installer's responsibilities; and
- describe the requirements for conversion.

Terminology

Term	Abbreviation (symbol)	Definition
Gas orifice		Hole or opening used to control the direction and amount of gas that is discharged into a burner

Installer's responsibilities

Conversions between natural gas and propane occur for a variety of reasons. In some cases, conversion of propane appliances to natural gas happens when this fuel type becomes available to an area. Another common conversion involves propane barbecues that are hooked up to a natural gas supply. Similarly, post-purchase conversion of new natural gas appliances to propane often takes place when buyers install these in an area where only propane is available.

As a result, each case involves different criteria and considerations.

In all cases, the installer must perform combustion analysis:

- to determine the completeness of combustion;
- to test for toxic gases; and
- to verify proper operation of the burners.

Installer's responsibilities

The conversion of appliances from one fuel type to another requires special knowledge and procedures. If performed incorrectly, the appliance will not function properly and may prove potentially dangerous. The gas technician/fitter must therefore perform all procedures properly and, in some cases, arrange for inspection of the converted appliance by the inspection authority or an agency authorized by the inspection authority.

Only authorized individuals have permission to perform fuel type conversion on appliances with inputs of 400 000 Btu/h or less. Check local regulations to determine the applicable qualifications.

Some jurisdictions may require a permit prior to converting an appliance to an alternative fuel. Always adhere to manufacturer's certified conversion instructions when these are available or obtain manufacturer's information.

Before performing a conversion, check the following conditions.

Appliance

Inspect the appliance and its heat exchanger to ensure that they are safe for continued use. Usually, inspection involves removal of burners, blowers, any humidifiers, etc., to check for scale, holes, cracks, water leaks, and seals. Existing appliance must have approval for conversion.

Input

When converting an appliance, the input must remain the same, and the new gas must have a marking on the rating plate.

Based on the same orifice diameter and gas pressure, propane supplies a greater input than natural gas.

The supply pipe size may need a replacement during the conversion. When converting from propane (11 in w.c.) to natural gas (7 in w.c.), new gas piping or tubing will likely need to satisfy sizing requirements. When converting from natural gas (7 in w.c.) to propane (11 in w.c.), unless the original piping or tubing was undersized, the requirement for a new piping or tubing is not likely. When new piping is required, safe removal and abandonment of the old piping is a must.

If a propane tank is no longer going to be used, do the following:

1) Shut off all valves.
2) Disconnect the pipe or tubing.
3) Plug the openings.

Venting and air requirements

The requirements for venting and combustion air are based on input and, therefore, do not normally undergo modification. However, checking the venting and air supply ducting to ensure their compliance with the Code requirements and their good physical condition is a must.

Requirements for conversion

Read CSA B149.1 requirements governing conversions below:

> 4.5.3 When an appliance is converted from the gas or fuel specified on the rating plate, the conversion shall be in accordance with the manufacturer's certified instructions. If there are no manufacturer's instructions for conversion of the appliance, the converted appliance shall be approved.

> 4.5.4 If an appliance is converted from one gas to another, the gas to which it is converted shall be marked on the appliance rating plate by the fitter making the conversion.

Conversion criteria

Conversions from natural gas to propane

There are three possible scenarios a gas technician/fitter may face when converting from natural gas to propane:

Conversion scenario	Action steps
A certified conversion kit is available.	Under these circumstances, the authorized gas technician/fitter may perform the conversion according to the manufacturer's certified conversion instructions—no additional approval is necessary. In this case, the manufacturer should include a label or sticker for the rating plate indicating that the conversion has taken place and the appliance is now operating on propane gas.
A similar model of appliance has received certification for propane, but a certified conversion kit is not available.	In this case, the authorized gas technician/fitter does the following: 1) Contacts the appliance manufacturer and obtains the necessary parts to convert the appliance. 2) Makes the conversion. 3) Contacts the agency certifying the appliance and requests an inspection and a new rating plate.
The appliance has certification for natural gas only and no conversion kit is available.	In this case, the inspection authority or an agency authorized by the inspection authority (field approved) must test and label the conversion. The gas technician/fitter should consider the costs of appliance recertification before deciding to proceed with the conversion.

Conversions from propane to natural gas

There are three possible scenarios the gas technician/fitter may encounter when converting from propane to natural gas:

Conversion scenario	Action steps	Other considerations
A certified conversion kit is available.	Under these circumstances, the authorized gas technician/fitter may perform the conversion according to the manufacturer's certified conversion instructions—no additional approval is necessary. In this case the manufacturer should include a label or sticker for the rating plate indicating that the conversion has taken place and the appliance is now rated for natural gas.	None
A similar model of appliance has received certification for natural gas but a certified conversion kit is not available.	In this case, the authorized gas technician/fitter does the following: 1) Contacts the appliance manufacturer and obtains the necessary parts to convert the appliance. 2) Makes the conversion. 3) Contacts the agency certifying the appliance and requests an inspection and a new rating plate.	When performing these conversions, the most important factors to consider are burner orifice sizing and manifold pressure settings. It is also very important to follow the manufacturer's instructions.
The appliance has certification for natural gas only and no conversion kit is available.	In this case, the inspection authority or an agency authorized by the inspection authority (field approved) must test and label the conversion.	Another factor to consider before deciding to proceed with the conversion is the costs of appliance recertification.

Burner orifice sizing

Performing conversions entails the purchase and installation of a properly sized gas orifice.

A gas orifice is a hole or opening that controls the direction and amount of gas discharged into a burner. Burner orifices come in a variety of shapes and sizes, and the actual size and configuration of each orifice depends on the following factors:

Factor	Description
The type of gas	This is the most critical factor in orifice design. Although the specific gravity of propane is higher than natural gas (which will limit the flow through an orifice), the heat capacity of propane is higher than natural gas. Therefore, producing the same amount of heat requires a lesser volume of propane than when natural gas is used. This means that a propane orifice will always be smaller than a natural gas orifice for the same heat output.
Appliance input	The orifice size directly affects the consumption rate of the appliance. The larger the appliance capacity, the larger the orifice size.
Manifold pressure	This influences the size of orifice required, since the greater the pressure, the greater the volumetric flow through the orifice. When an orifice size changes during a fuel type conversion, adjustment of the manifold will often be required. In all cases, checking this factor is a must.

Always keep the appliance input rate the same as the one that the appliance manufacturer specified on the appliance rating plate or on the certified conversion kit instructions. Improper input rate adjustment can result in poor burner flame characteristics and/or the production of carbon monoxide. Also, overfiring can result in a potential fire hazard as well as overheating and destruction of the heat exchangers.

Data about the size of orifice to input capacity for natural gas and propane is available from manufacturers. Also, refer to Annex I *General information* of CSA B149.1 for orifice sizing information.

Manifold pressure

In addition to changing the orifice size, the appliance manifold pressure requires adjustment. This procedure requires you to use pressure measuring equipment (a manometer) to confirm that the correct manifold pressure has been obtained.

1) In the case of certified conversion kits, the appliance manufacturer will indicate whether or not any adjustments to the manifold pressure are required.
   In all cases, check that the gas supply pressure immediately upstream of the manifold falls within the recommended range for the appliance.
2) When no certified conversion kits are available but the appliance has received certification for both fuels, obtain original testing data from the agency certifying the appliance. Adjust the manifold pressure accordingly.

Always keep the manifold pressure within the range specified by the appliance manufacturer, since adjustments beyond this range can adversely affect the burner operation.

- Pressures that are too low may not entrain enough air into the burner.
- Pressures that are too high may entrain too much air.
- In either case, poor burner flame characteristics can occur, resulting in production of carbon monoxide.