8) Where can you find requirements for propane tank clearances?
   a) Provincial Act/Regulation
   b) CSA B149.2 *Propane storage and handling code*
   c) Manufacturer's service bulletins

9) Where can you find requirements for pipe sizing?
   a) CSA B149.1 *Natural gas and propane installation code*
   b) Manufacturer's service bulletins
   c) CSA B149.3 *Code for the field approval of fuel-burning appliances and equipment*

10) Where can you find requirements for gas technician/fitter qualifications?
   a) Directives and Bulletins from the Provincial Authority
   b) CSA B149.1 *Natural gas and propane installation code*
   c) Provincial Act/Regulation

2. Technical manuals and manufacturer's specifications

Overview

Purpose

Manufacturer's technical manuals and specifications are materials that the gas technician/fitter will need for installations, parts replacement, or troubleshooting procedures. This Chapter will explain where the various data is located and how the technician/fitter can interpret it.

Objectives

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

- locate manufacturer's installation data; and
- troubleshoot problems.

Assignment Questions – Chapter 1

1) Which organization publishes the CSA B149 series of Code books?
   a) TSSA
   b) CGA
   c) CSA Group

2) In which code would you find the valve train requirements for a one-of-a-kind appliance requiring field approval?
   a) CSA B149.1 *Natural gas and propane installation code*
   b) CSA B149.3 *Code for the Field Approval of Fuel-burning Appliances and Equipment*
   c) CSA B149.2 *Propane storage and handling code*
   d) CSA B139 *Installation code for oil-burning equipment*

3) When installing a gas-fired appliance, where would you find the appliance height and space requirements?
   a) Appliance Certification Standard
   b) Provincial regulations
   c) Manufacturer's specifications

4) Where would a service technician find information on a particular appliance's service problems?
   a) Manufacturer's service bulletins
   b) CPSC (Consumer Product Safety Commission)
   c) CSA Group

5) Where can you find legal orders regarding produce approvals or installation practices?
   a) Provincial Act/Regulation
   b) Directives and Bulletins from the Provincial Authority
   c) Manufacturer's service bulletins

6) Where can you find a value train diagram for field approval?
   a) CSA B149.3 *Code for the field approval of fuel-burning appliances and equipment*
   b) CSA B149.1 *Natural gas and propane installation code*
   c) CSA B149.2 *Propane storage and handling code*

7) Where can you find guidelines for service and maintenance of a specific appliance model?
   a) CSA B149.1 *Natural gas and propane installation code*
   b) Directives and Bulletins from the Provincial Authority
   c) Manufacturer's service bulletins

Terminology

Term	Abbreviation (symbol)	Definition
Manufacturer's certified installation and service manual		From a manufacturer, document with all necessary information for the installation and basic maintenance of an appliance
Troubleshooting procedure		Series of specific steps to locate the source of a problem to make the product or process operational again

Manufacturer's installation data

Manufacturers provide certified installation and service manuals with their appliances. Although the literature varies from company to company and from product to product, the manual will include all necessary information for the installation and basic maintenance of the appliance. It is up to the gas technician/fitter to find it!

The following excerpts from manufacturer's manuals show the various ways of presenting installation information. Again, it is up to the gas technician/fitter to *read the complete manual* and study the charts and diagrams before work commences in order to begin locating the tools, hardware, wiring, and piping needed for a trouble-free installation.

Gas appliance manufacturer's installation instructions typically include a list of tools and measuring instruments needed to complete the installation. They also include instructions on how to uncrate, locate, install, test, and commission the appliance.

Model number

Manufacturers often publish one set of instructions for many different models of the same series of appliances. Table 2-1 shows a typical example of the different vent and combustion pipe details for six different models of the same appliance.

Table 2-1
Example of air and venting information for various models

Model number or series	Combustion air pipe	Combustion air pipe terminal	Vent pipe	Vent terminal
Model 40ME	2 in diameter	2 in diameter	2 in diameter	2 in diameter
Model 50 ME	20–50 ft	90° elbow	20–50 ft	45° elbow
Model 40/50ME				
Model 70ME	3 in diameter	3 in diameter	3 in diameter	3 in diameter
Model 80ME	20–60 ft	90° elbow	20–60 ft	90° elbow
Model 70/80ME				

Tools and hardware

Manufacturers will often indicate the tools and hardware required for the installation, as shown by the following examples:

> Level each Unit by adjusting levelling bolts or legs. Use a spirit level and level Unit four ways.... Use a Robertshaw test instrument with special disc type thermocouple, or reliable "surface" type thermometer.

They may also indicate when hardware is supplied, for example:

> Secure in place with two hex nuts supplied.

Wiring and piping

Most manuals come with wiring and piping diagrams that often come with schedules (Table 2-2) and keys (Table 2-3).

Table 2-2
Example of gas orifice schedule

Gas pilot orifice schedule	Natural gas	LP gas
J(R) 15A-10, J(R) 30A-10(12), J50A-15-flame rod	Std. #44	N/A
J(R) 15A-10, J(R) 30A-10(12) Scanner	Std. #36	Std. #44
J50A-15 Scanner	Std. #36	Std. #44

Table 2-3
Example of wiring diagram key

Description	
Key	**Component**
A67	Receiver–infrared
B3	Motor–blower
GV1	Valve–gas-millivolt
R32	Potentiometer
S1	Thermostat–room
S10	Control–fan
S66	Switch–wall
TC1	Thermopile
Y1	Generator–piezo

Replacement parts

The manuals will sometimes specify details on the replacement parts, as shown in the following example:

> Replacement wire must be type "TW" (63°F or 35 °C temperature rise) wire or equivalent.

Troubleshooting problems

This section provides general information about troubleshooting problems. Its purpose is to help you develop a consistent, analytical approach to troubleshooting problems.

Troubleshooting procedure

In any troubleshooting situation, it is necessary to consider the entire system and sequence of operation including not only the burner, controls, wiring, etc., but also air supply, fuel supply, and the condition and characteristics of the flame itself. In order to cover all areas of burner operation, the troubleshooting procedure is broken down into a series of specific steps.

Step 1—Know the system

In other words, do your homework. Study the manufacturer's technical manuals. Know how the system works.

Keep up with the latest service bulletins. Read them and then file them in a handy place. This month's bulletin may cover the problem on the appliance, giving the cause and remedy.

Step 2—Ask questions and look for symptoms

Usually, the information available on arrival at the installation consists of a simple statement such as "The burner shuts down." Start by asking all the questions possible of anyone that might have some knowledge of what happened.

For example:

- When does the shutdown occur?
- What part of the cycle?
- How long after the startup?
- Does a shutdown occur after every start?
- How is the light off?

These are only sample questions. The information you need will depend on the individual situation.

Examine the equipment and look for symptoms. A symptom is a sign that the equipment is operating abnormally (e.g., discoloration is a symptom of excessively high heat).

Step 3—Evaluate Your Information

Use the supplied manufacturer's manuals, charts, service suggestions, together with your personal experience, to evaluate any information you have concerning the problem.

The conclusions you have drawn at this stage only provide an idea of where to look for the exact solution to the problem.

Step 4—Make a trial run

Cycle the burner system and observe.

- Was each step of the startup according to the design sequence?
- Did any deviations occur?
- Did the shutdown occur exactly as described?
- Did anything else happen?
- Have any new facts been established

While you perform the trial run, make a note of any new information.

Step 5—Re-evaluate

You can often make the re-evaluation of available facts during the trial run. Look over your list of possible causes and decide which are most likely and which are easiest to verify.

Remember that in some instances, more than one factor may be contributing to the problem and you must consider this in the solution.

Reach your decision on the leading causes and plan to check them first.

Step 6—Test your conclusions

After determining the apparent cause(s) of the appliance problem, perform a second test run to see if the evaluation is correct. If you have not found the answer, you must make a new evaluation that includes any new information that you have obtained during the second test run. More than one re-evaluation test may be necessary to get all the information you need to positively identify the cause(s) of the problem.

Step 7—Correct the condition(s)

At this stage, you would be confident in adjusting or replacing the faulty part(s). (Note that you cannot adjust all parts in the field—check with the manufacturer's manual.) Do a final run-through to check that you have solved the problem. When ordering replacement parts, make sure that you provide the model number of the equipment.

Table 2-4
Sample manufacturer's troubleshooting guide
(to answer questions 5-8)

Nature of trouble	Possible Cause	Service
Unable to light Pilot	1. Gas knob dial not correctly positioned 2. Pilot orifice clogged 3. Pilot tube pinched or clogged 4. Air in gas line	1. Follow lighting instruction 2. Clean or replace 3. Clean, repair, or replace 4. Purge air from gas line
Pilot does not stay lit when red button is released	5. Loose Thermocouple 6. Thermocouple breakdown 7. Safety magnet breakdown 8. Thermostat's single use gas shut-off device has opened	5. Tighten connection at thermostat 6. Replace 7. Replace Thermostat 8. Replace Thermostat
Not enough hot water	9. Heater undersized 10. Low gas pressure	9. Reduce rate of hot water usage 10. Check gas supply pressure and manifold pressure
Water too hot or not hot enough	11. Thermostat setting too high or low 12. Thermostat out of calibration 13. High water temperature	11. Change settings as required 12. Replace 13. Thermostat out of calibration, replace
Yellow flame	14. Scale on top of burner 15. Combustion air inlets or flueway restricted 16. Not enough combustion or ventilation air supplied to the room	14. Shut off heater and remove scale 15. Remove lint or debris and inspect air inlet opening for restrictions 16. Refer to Section E in Introduction section of this manual
Rumbling noise	17. Scale or sediment in tank	17. Clean tank - See Maintenance Sec IF

CAUTION!

For your safety, DO NOT attempt to repair thermostat, burner or gas piping. Refer repairs to qualified service personnel.

How to Obtain Service Assistance

1) Should you have any questions about your new water heater, or if it requires adjustment, repair, or routine maintenance. It is suggested that you first contact your installer, plumbing contractor or previously agreed upon service agency. In the event that the firm has moved, or is unavailable, refer to the telephone directory commercial listing or local utility for qualified service assistance.
2) Should your problem not be solved to your complete satisfaction, you should contact the Manufacturer's Regional Service Manager at the office closest to your location as listed below or the National Service Department at 1-800-000-000.

When contacting the manufacturer, the following information should be made available :

1) Model and serial numbers of the water heater as shown on the name plate on the jacket of the heater.
2) Address where the water heater is located and can be seen.
3) Name and address of installer and any service agency who performed service on the water heater.
4) Date of original installation and dates any service work was performed.
5) Details of the problem as you can best describe them.
6) List of people, with dates, who have been contacted regarding this issue.

Assignment Questions – Chapter 2

1) Do manufacturers often publish one set of instructions for different models of the same series of appliances?
   a) Yes
   b) No

2) Which of the following are often included in the manufacturer's installation manual?
   a) Wiring diagrams and architectural designs
   b) Piping diagrams and Floor plans
   c) Piping and wiring diagrams