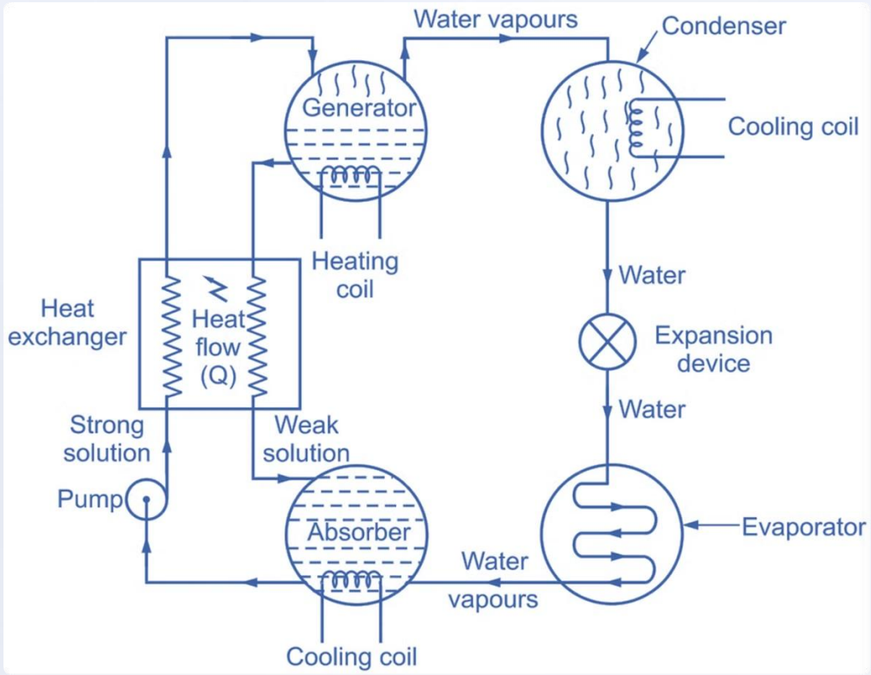


CSA Unit 16 : Gas Fired Refrigerators

Chapter 1
Absorption Refrigerators: Operation and Principles

Absorption refrigerators have no moving parts, are noiseless, and require only a small flame to operate. These unique refrigeration systems use a sealed pressure system where refrigerant travels through the system, absorbing and releasing heat at key areas to cool the refrigerator and freezer compartments.

Created
MK **by Mike Kapin**

Basic Components of Absorption Refrigerators

Generator (Boiler)

The heat energy source that begins and maintains the operating cycle. The generator heats the refrigerant, turning it into a vapor so it separates from the water solution and travels to the condenser.

Condenser

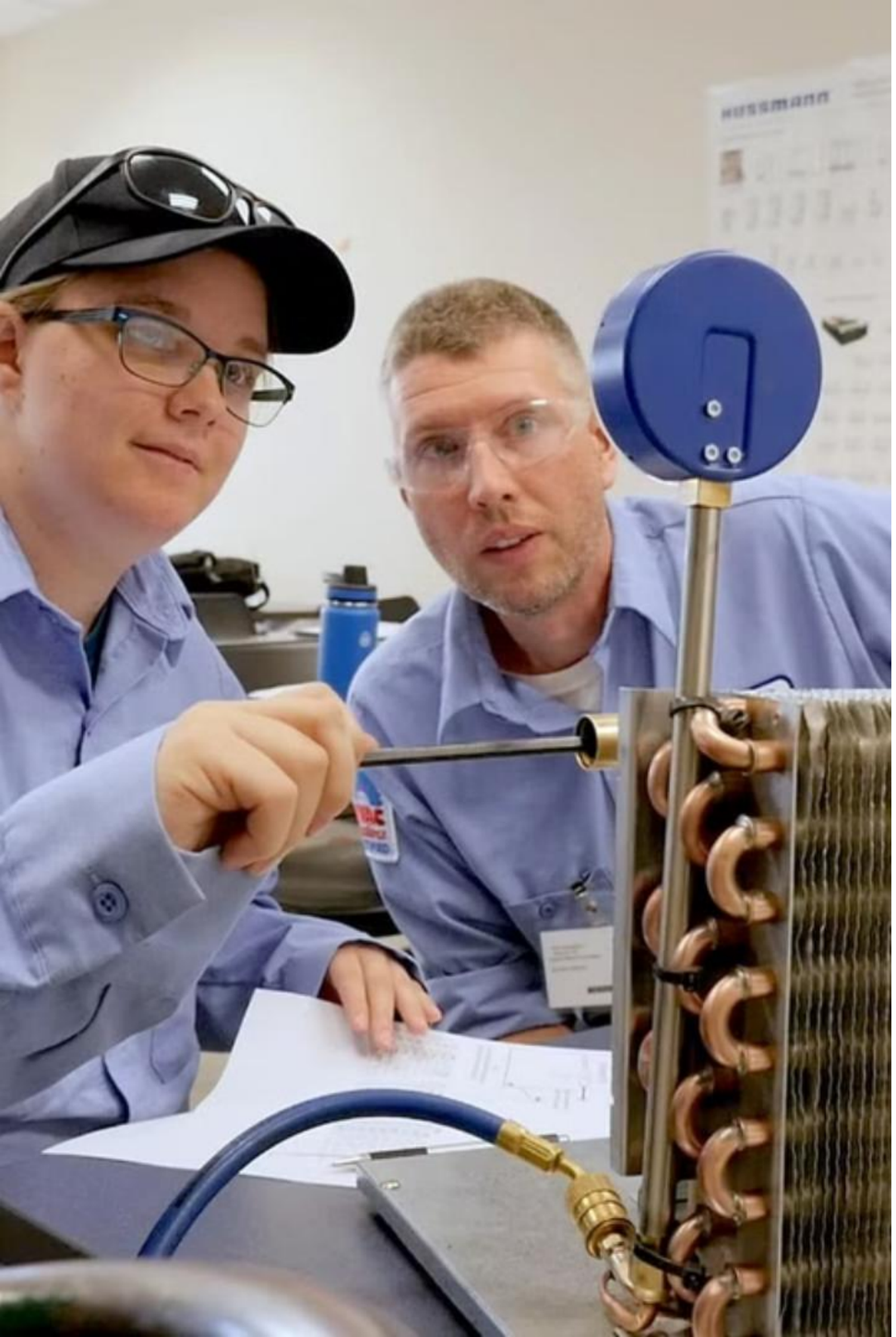
Removes heat from the vaporized refrigerant, causing it to condense into a liquid. Condenser fins transfer heat from the fridge to the condenser coils.

Evaporator

The liquid refrigerant encounters pressurized hydrogen and evaporates. This heat transfer makes the tubes cold, cooling the refrigerator.

Absorber

Consists of a coil and tank. The liquid inside attracts and absorbs the refrigerant from the evaporator, storing it until the generator begins the cycle again.



Learning Objectives

Describe Basic Operating Principles

Understand how absorption refrigeration systems function without moving parts

Describe Generator Components

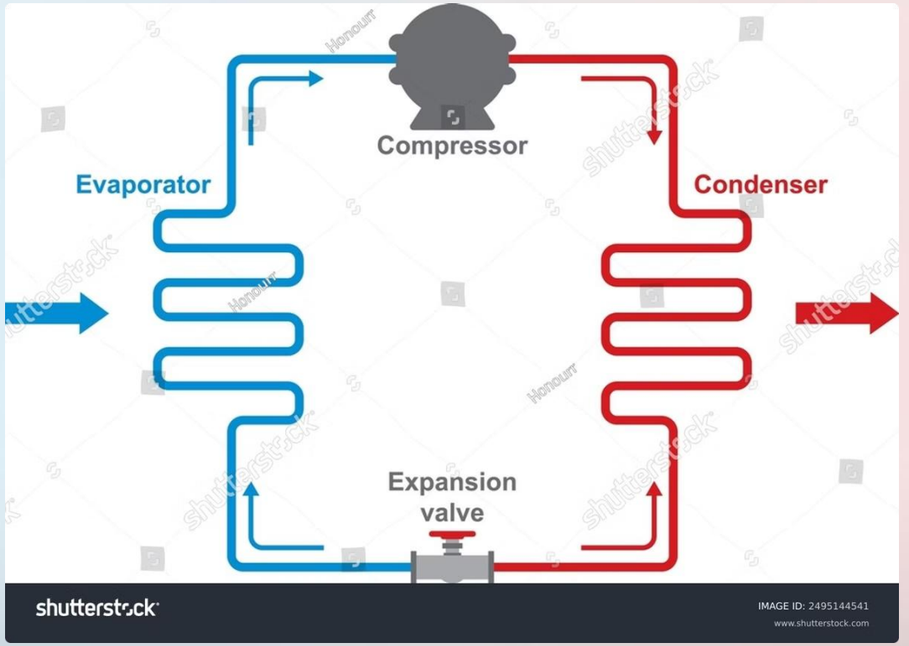
Learn about the key components in gas-fired refrigerator generators

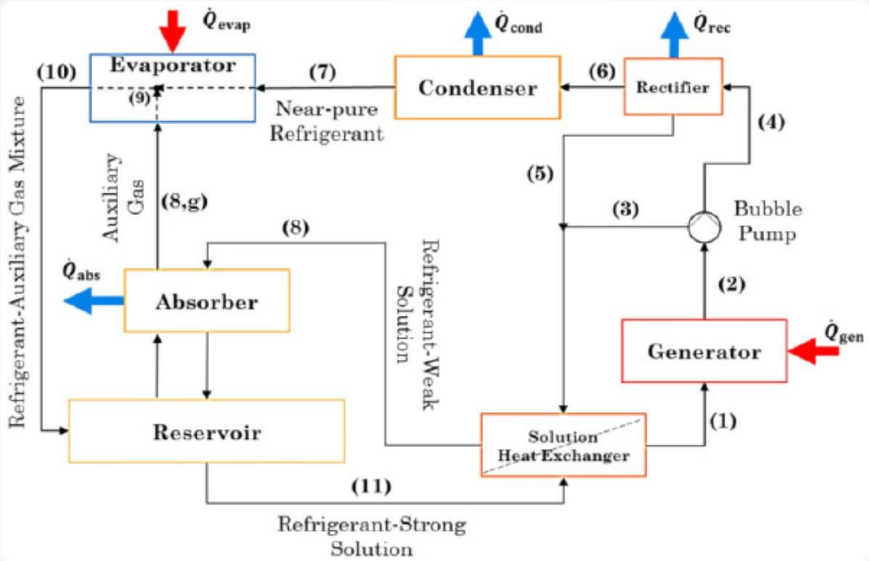
Understand System Types and Safety

Identify different absorption system types and their safety considerations

Key Terminology

Term	Abbreviation	Definition
Automatic energy selector system	AES	A system that lets the circuit board in the refrigerator select the most appropriate available heat source
Condenser		Removes heat from the vapourized refrigerant
Condenser fins		Transfer heat from the fridge to the condenser coils
Condensing effect		Changing of gas into a liquid
Orifice housing		Provides the correct air-gas ratio
Thermal mastic		Heat transfer compound
Thermostatic valve		Senses the temperature of the evaporator and varies the heat input





Basic Operating Principles

An absorption-refrigeration system uses three key elements to create a cooling effect:

Refrigerant

The substance that absorbs and releases heat during the refrigeration cycle

Adsorbent

The material that absorbs the refrigerant during part of the cycle

Heat

The energy source that drives the refrigeration process

Unlike compression refrigeration systems, the basic absorption cycle uses no moving parts. The cycle depends on the action and reaction between the refrigerant and the adsorbent under various pressure and temperature conditions in a sealed system.

Cooling and Condensing Effects

Cooling Effect

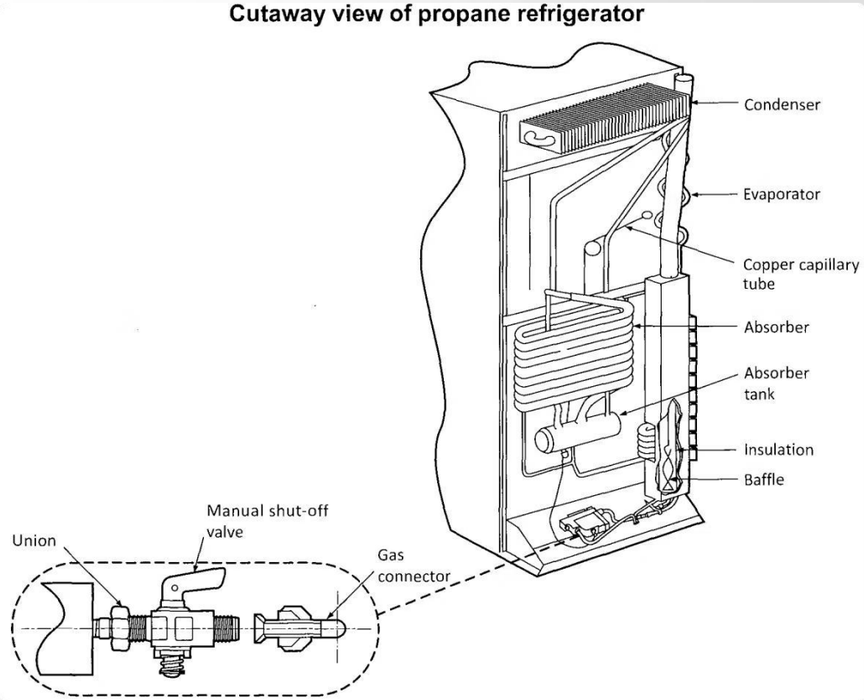
The system makes use of the cooling effect that results when liquids flash to a gaseous state. This is similar to blowing on the back of your hand when there is water on it - the blowing causes the water to evaporate and your hand feels slightly cold.

Condensing Effect

The condensing effect occurs when heat is removed from a gas, changing it back into a liquid. This process happens in the condenser section of the refrigerator, where heat is transferred away from the refrigerant.

Cutaway View of Propane Refrigerator

This cutaway view shows the main components of a propane refrigerator. Ammonia is liquefied in the finned condenser coil at the top rear of the refrigerator. The liquid ammonia then flows into the evaporator (inside the freezer section) and is exposed to circulating flow of hydrogen gas, which causes the ammonia to evaporate, creating a cold condition in the freezer.



Refrigerant Flow Circuits

Solution Circuit

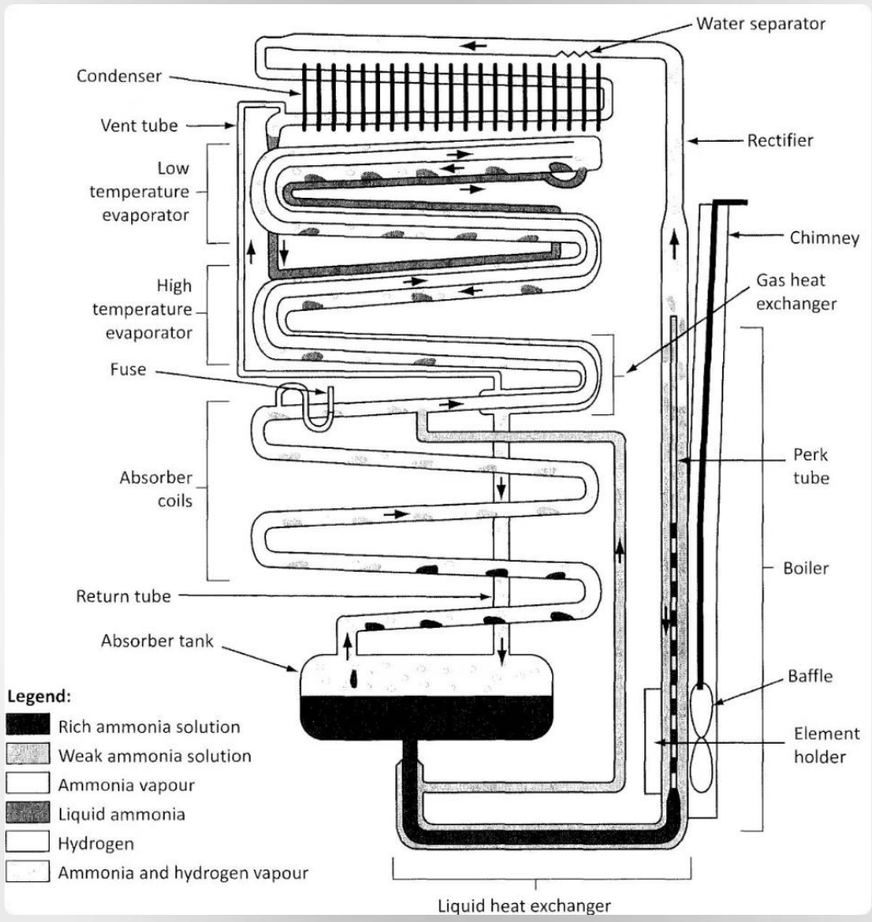
Contains the ammonia-water solution that circulates between generator and absorber

Condensing Circuit

Where ammonia vapor is cooled and condensed into liquid

Hydrogen Circuit

Where hydrogen gas helps evaporate the ammonia to create cooling



Flow of Refrigerant: Step 1

Generator (Boiler) Heats Strong Solution

The perk tube is provided with a strong ammonia solution (high percentage of ammonia to water) from the absorber tank.

When heated, the ammonia in the strong solution begins to vaporize, creating bubbles with a percolating effect.

The ammonia vapor pushes the now weakened solution up and out of the perk tube.

Ammonia Vapor Travels to Condenser

The ammonia vapor (gas) leaving the perk tube goes upward towards the top of the cooling unit.

Little of the water vapor travels upwards because ammonia vaporizes at a lower temperature than water, causing the two to separate.

A rectifier, and sometimes a water separator, catches the little water that vaporizes.

Weak Solution Travels Back to Absorber

As rich vaporized ammonia travels to the condenser, the now weakened, still warm solution flows downward to the top of the absorber coils and enters the absorber tank at a cooler temperature.

When flowing downward through the coil, the weak solution picks up evaporated ammonia from the evaporator. This absorption process generates heat that is dissipated through the absorber fins.

Flow of Refrigerant: Step 2

Ammonia Vapor Cools in Condenser

Ammonia vapor enters the condenser where it undergoes cooling by air passing through the condenser metal fins at the rear of the refrigerator.

The cooling effect of the condenser, coupled with a series of reductions in pipe size, forces the ammonia vapor into a liquid state, where it enters the evaporator section.

Liquid Ammonia Evaporates When It Contacts Pressurized Hydrogen

Liquid ammonia coming in contact with pressurized hydrogen absorbs heat and evaporates. This is the principle whereby the heat is absorbed from both the freezer and refrigerator boxes.

Liquid ammonia enters the low temperature evaporator (freezer) and trickles down the pipe, wetting the walls. Hydrogen passes over the wetted walls, causing the liquid ammonia to evaporate at an initial temperature of around -20°F (-29°C).

The Ammonia Vapor and Hydrogen Drop to the Absorber Tank

The ammonia vapor created through the evaporation mixes with the already present hydrogen vapor, making it heavier.

Since the ammonia and hydrogen vapor mixture is heavier than the purer hydrogen, it drops down through the return tube to the absorber tank.

Flow of Refrigerant: Final Step

Strong Solution Absorbs Ammonia Vapor

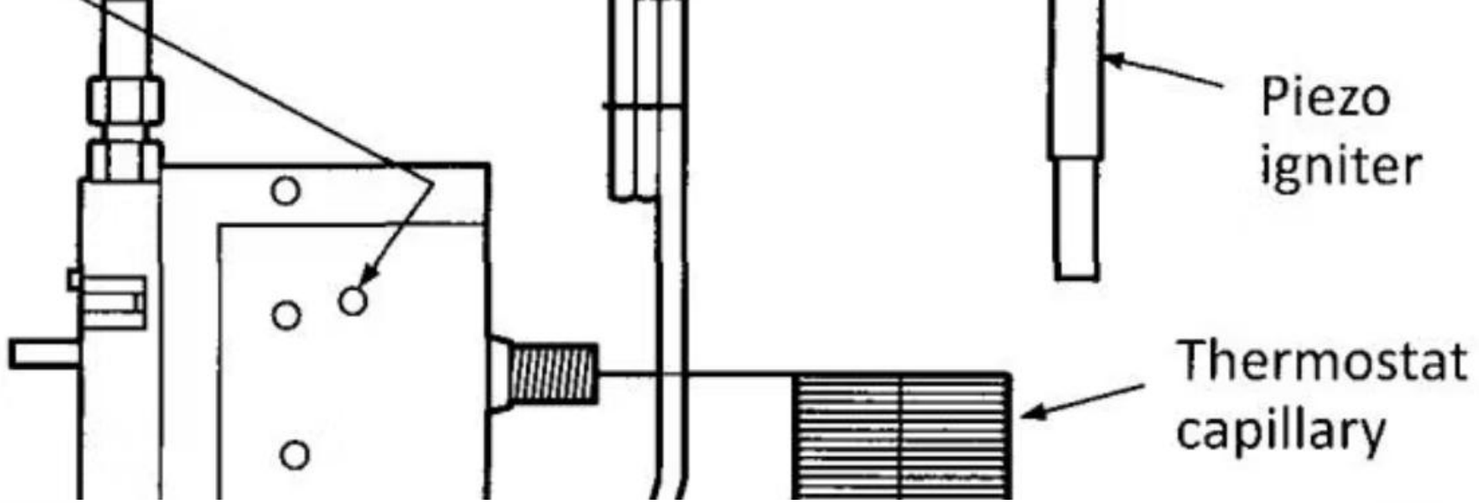
When the ammonia and hydrogen vapor mixture enters the absorber tank through the return tube, much of the ammonia vapor is absorbed into the surface of the strong solution, which occupies the lower half of the tank.

Hydrogen Returns to the Evaporator

Now lighter, the ammonia and hydrogen mixture (now with less ammonia) begins to rise up the absorber coil. The weak ammonia solution trickling down the absorber coil from the top is "hungry" for the ammonia vapor that is rising up the absorber coil with the hydrogen.

Cycle Continues

This weak ammonia solution eventually absorbs all the ammonia from the mixture as it rises, allowing pure hydrogen to rise up the inner pipe of the evaporator section, completing the cycle.



Generator Components

Although various brands and models use different components, configured in vastly different ways, this drawing represents a standard refrigerator propane generator system. The test port (shown closed) is visible in the diagram.

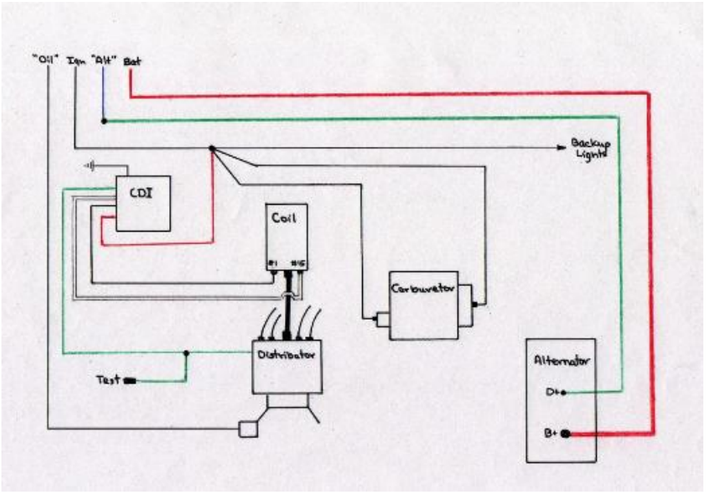
Modern Generator Assembly

Electronic Ignition

Modern refrigerators use electronic ignition systems that are more reliable and efficient than older manual systems.

Electronic Sensing

Temperature sensors provide feedback to the control system, allowing for precise temperature control and improved efficiency.



Thermostatic Valve

The amount of cooling depends on the amount of heat produced by the flame. The higher the flame, the faster the cooling, and vice versa.

The thermostatic valve senses the temperature of the evaporator (through the thermostat capillary) and varies the heat input (by modulating the gas pressure delivered to the burner) to make the operation automatic.

This ensures that the correct temperature is maintained in the refrigerator.

Figure 1-5
Thermostatic valve—top view

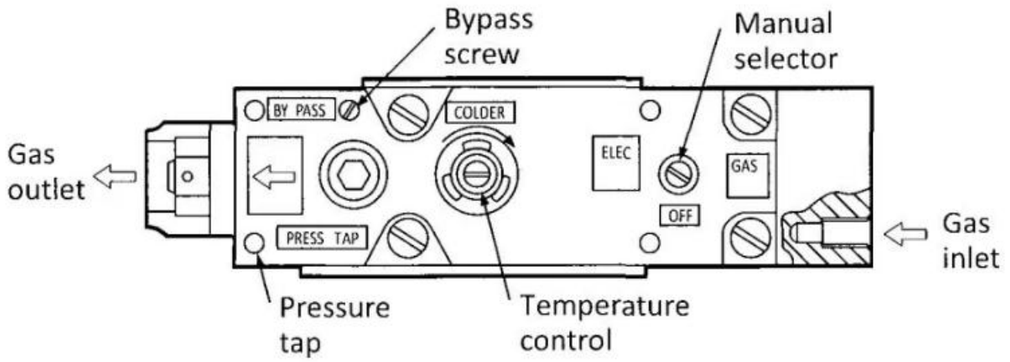
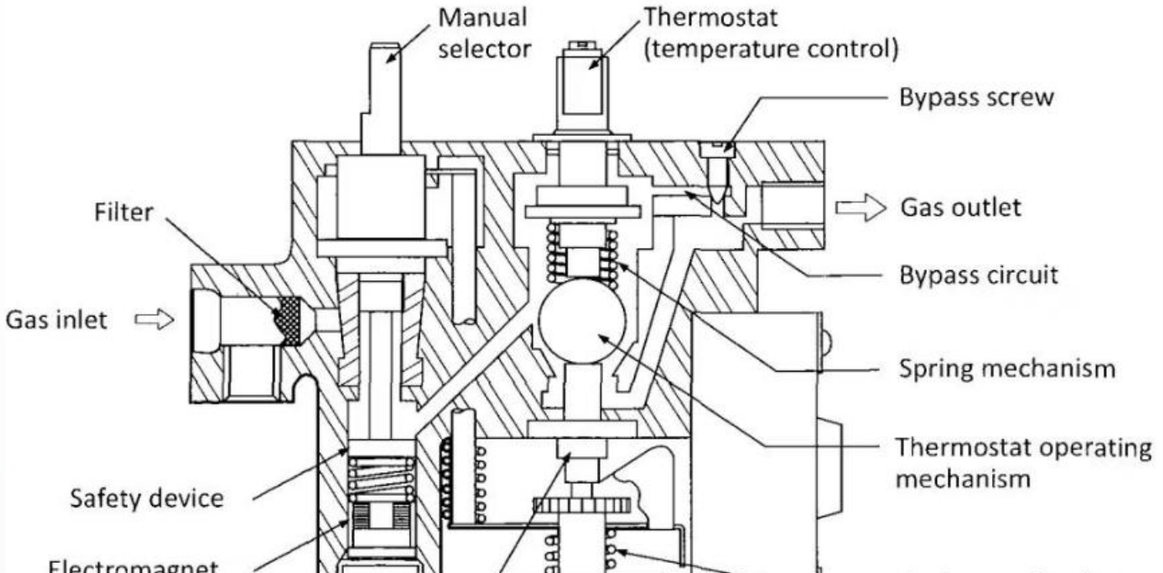


Figure 1-6
Thermostatic valve—cutaway view



Thermostatic Valve Components

Manual Selector

For electrical or gas operation. Most absorption refrigerators can operate either on propane gas or electricity. Some units have automatic energy selectors that automatically choose the most appropriate source of power.

Thermostat Control

When the thermostat calls for cooling, the maximum pressure of propane is allowed through the orifice of the burner. The thermostat control adjusts the amount of pressure admitted and, thus, controls the size of the flame and the amount of heat generated.

Bypass Screw

When the desired temperature is reached, the thermostat blocks the "open" pathway and routes the propane through the bypass circuit. The bypass section only allows a very small amount of gas through, just enough to keep the thermocouple and the refrigeration system heated.

More Thermostatic Valve Components

Pressure Tap

For most propane-fired refrigerators, the correct gas inlet pressure is 11 inches w.c. Referring to the manufacturer's specifications can help determine the exact pressure. This appliance is probably the most sensitive when it comes to gas pressure; there is very little tolerance in the gas pressure before problems begin.

Thermostatic Control Mechanism

Operates in relation to the temperature of the evaporator fins. With the safety device open, the gas flows normally through the main passage up to the thermostat operating mechanism. By increasing the temperature at the evaporator, the gas inside the thermostat capillary increases in pressure, causing the set and pin to rise.

Orifice and Orifice Housing

Function

The orifice controls the amount of gas injected into the burner. The main function of the orifice housing is to provide a correct air-gas ratio. As the diameters of the air and gas passages are preset, this component does not require adjusting.

Importance

The orifice and the gas pressure set the size of the flame. If one or the other is incorrect, then the flame will not be correct. Often, microscopic debris accumulates around the orifice hole, making it smaller. Also, oil from the propane tank and other propane components can be deposited on the orifice, making it easier for debris to stick to it.

Orifice Cleaning and Maintenance

Cleaning Instructions

Do not use sharp tools to clean the orifice. To clean it, soak it in non-oily solvents and then blow air through it.

Modern Orifices

Older models have a hole drilled through them. Modern orifices are a thin ruby cylinder perforated with a laser ray that ensures high precision and absence of burrs in the hole. A modern orifice is, therefore, more difficult to accidentally enlarge. The cleaning rules, however, still apply.

Dust and Lint Issues

Dust or lint present in the air is sucked in through the primary air openings and collects at the openings, slowly changing the character of the flame from blue (hard and low) to yellow (soft and elongated). A growing yellow flame is your first warning that the housing must be cleaned.

Flame Characteristics and Orifice Size

Flame color	Characteristic
Blue	Hard and low
Yellow	Soft and elongated
Flame pattern	Orifice is
Small and lean	Too small
Large and rich	Too big

If the flame pattern (small and lean) indicates that the orifice is too small and cleaning does not change the flame, replace the orifice. The same applies if the flame pattern (large and rich) indicates that the orifice is too big.

Be sure to clean the burner when changing the orifice.

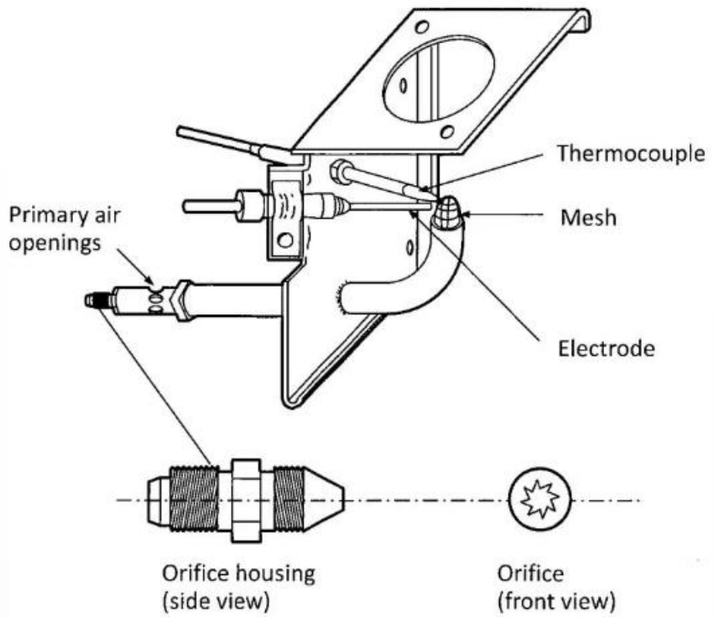
Burner Maintenance

Burner Requirements

The burner must be clean and undamaged. The mesh or screen has to be in place at the top of the burner. The screen protects the burner from debris falling down into it and also helps form the flame.

Cleaning Reminders

- Clean burners yearly with a stiff brass bristle brush to eliminate dirt in each opening in the burner mesh
- Clean the burner venturi with pipe cleaners or with a venturi brush



Piezo Igniter

Operation

The igniter is typically the piezoelectric type, which contains a spring-loaded striking plate that, when pushed, strikes a quartz crystal.

The crystal generates an electrical charge that is transferred down the wire to the electrode.

When properly installed and working, the high voltage between the electrodes and the burner will create a spark at the burner, igniting any unburned gas.

Common Failures

If it fails to operate, the cause may be:

- Too great a distance between the electrode and the burner (the ideal is 2-3 mm distance)
- Creepage
- Poor electrical contact

Wire leading to the electrodes should not have contact with any metal parts.

Thermostat Bulb or Sensor

Traditional Design

The bulb of the thermostatic valve is in the shape of a wound capillary tube that is positioned at a specific point on the evaporator (usually the fins) of the refrigerator box. Modern bulbs are designed so the last 4 inches (10 cm) of the capillary is the sensing element.

Electronic Controls

On refrigerators using the electronic type of control, a sensor or sensors that transmit the information needed for the control of all system functions are used to determine the temperature.

Refer to the specific manufacturer's information for each model of fridge.

Carbon Monoxide Sensor

Integration

Some refrigeration units include a carbon monoxide (CO) sensor that is integrated into the millivolt (thermocouple-driven) safety valve.

Function

This device alerts the user that there are levels of carbon monoxide above the allowable 50 ppm and shuts down the burner should dangerous levels of CO be present.

Power Source

These units operate from a battery, and the testing procedures include a battery check as well as the CO sensor check.

Service Features

Newer models feature a disconnect that allows separation of the CO sensor unit from the appliance should there be any need to service the product.

CO Sensor Requirements

Code Requirements

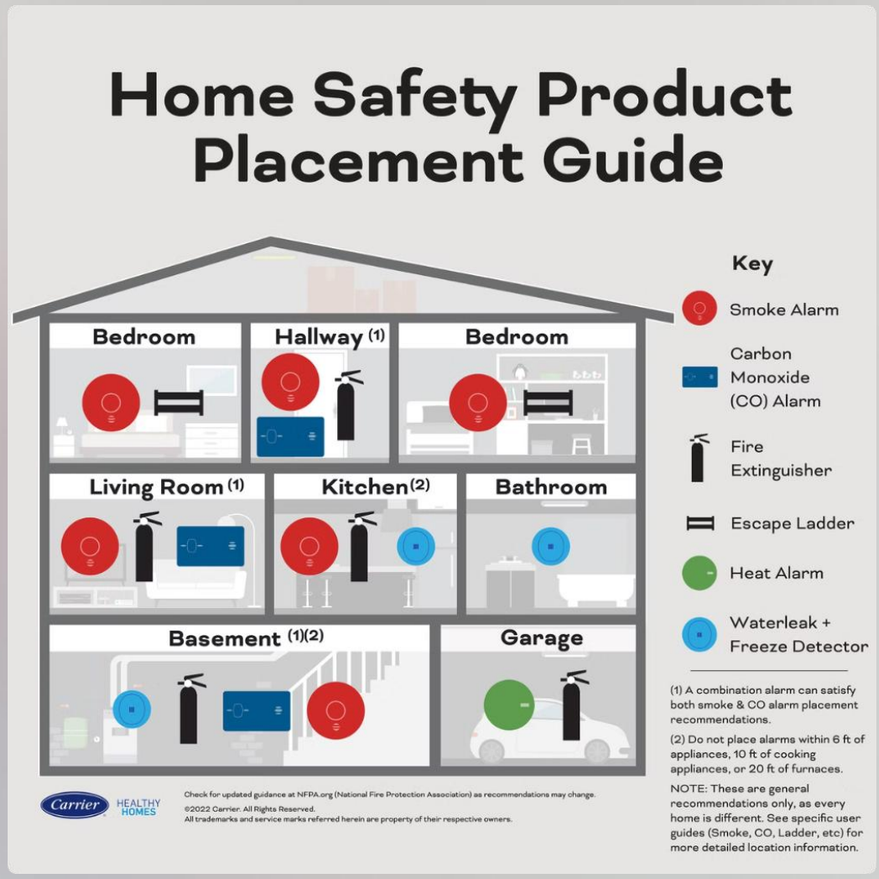
Propane refrigerators installed in dwellings prior to the provincial adoption of the 2010 CSA B149.1 Code, which required they be of a direct vented type, must have a carbon monoxide safety shut-off system.

Testing Procedures

Check with the manufacturer's instructions on how to test this sensor. Testing procedures typically include both battery checks and sensor functionality verification.

Safety Importance

The CO sensor is a critical safety component that prevents potentially dangerous carbon monoxide buildup in living spaces where these refrigerators are installed.



Manual Gas Valve

Function

The manual gas valve is the main connection between the gas supply and the refrigerator. It consists of a main housing and a manually activated on/off valve.

Operation

This valve allows the user to completely shut off gas flow to the refrigerator when needed for service or when the appliance is not in use for extended periods.

Location

The manual gas valve is typically located at the rear of the refrigerator where the gas supply line connects to the appliance.

Types of Systems and Safety Considerations

A gas technician/fitter may be called upon to service the system that provides heat to absorption refrigerators. The associated gas burner and its heat exchanger are part of the gas technician's/fitter's expertise.

Scope of Work

A gas technician/fitter is not a refrigeration technician, so the refrigeration components should be left up to that trade.

System Types

There are different types of absorption refrigeration systems, each with their own specific components and safety considerations.

Safety Focus

Understanding the safety aspects of each system type is crucial for proper service and maintenance.

Lithium-Bromide Systems

System Characteristics

The water-lithium-bromide system is similar to the ammonia-water system. However, instead of cooling fins on the condenser and absorber, there are circulation water tubes that carry away the heat.

Additionally, it does not use hydrogen at high pressure to carry the refrigerant vapor. Instead, it operates at very low pressures to enable the temperatures in the evaporator and refrigerator cabinet to fall to the required degree of coldness.

Applications

Larger applications primarily use these systems, which are covered in Unit 28 Gas-fired air conditioning.

Lithium-Bromide Safety

Safety Consultation

Before working with these systems and chemicals, consult the company policy and your supervisor.

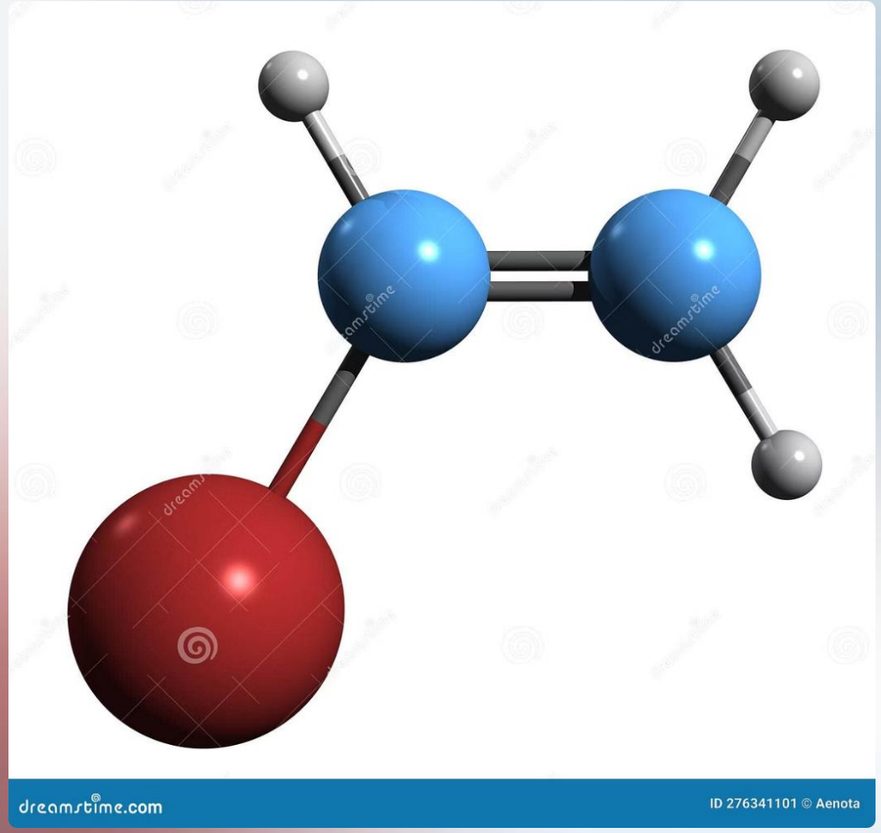
Solution Properties

Lithium-bromide solution is:

- Non-toxic
- Non-flammable
- Non-explosive
- Chemically stable

Hazards

However, it becomes corrosive when exposed to air and may irritate skin, eyes, and mucous membranes.



Lithium-Bromide Emergency First Aid

Flush with Water

If you come in contact with lithium-bromide solution, flush the contacted area with lukewarm water for at least 15 minutes.

Remove Contaminated Clothing

Take care not to spread the chemical. If contamination is extensive, remove clothing under running water.

Seek Medical Attention

If irritation persists, seek medical attention immediately.

Ammonia Absorption Safety

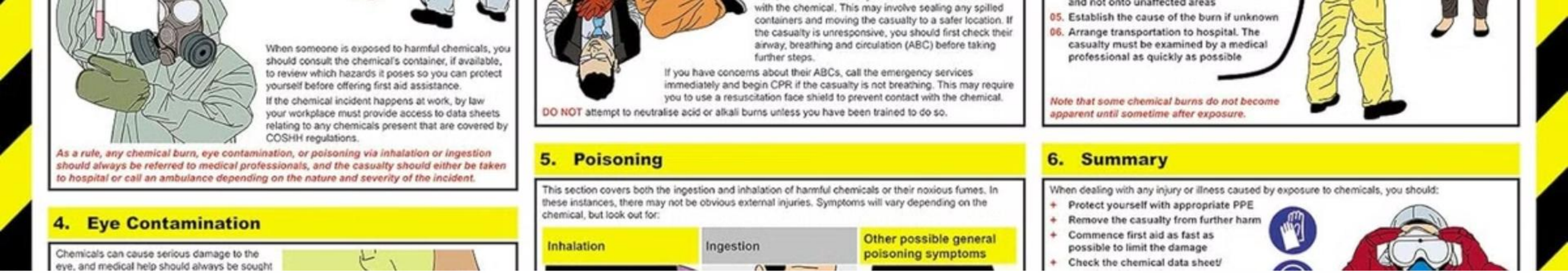
Sealed Unit Warning

The ammonia absorption cooling unit is a sealed unit that is not meant to be tampered with in any way. The cooling unit contains ammonia, sodium chromate, and hydrogen at a pressure of 300 to 350 psi (2068 to 2413 kPa).

Do not drill, weld, or cut on the cooling unit. Rupturing the cooling unit will immediately engulf the area in ammonia and hydrogen, displacing air.

Hazards

Hydrogen is flammable, and ammonia is an intensely irritating gas that can render one unconscious.



Ammonia Emergency First Aid

Key First Aid Principles

The keywords for first aid involving ammonia are air and water.

Ammonia Exposure

If you inhale ammonia or get the liquid ammonia on you, immediately:

- Get to fresh air
- Flush any affected area of your body or clothing with plenty of water

Sodium Chromate Exposure

Sodium chromate is a carcinogen. If you get sodium chromate on you, wash thoroughly with soap and water.

If you have any lingering effects from or any doubts about an encounter with the ingredients of a cooling unit, seek medical attention.

Working Safely with Cooling Units

Always Have an Exit

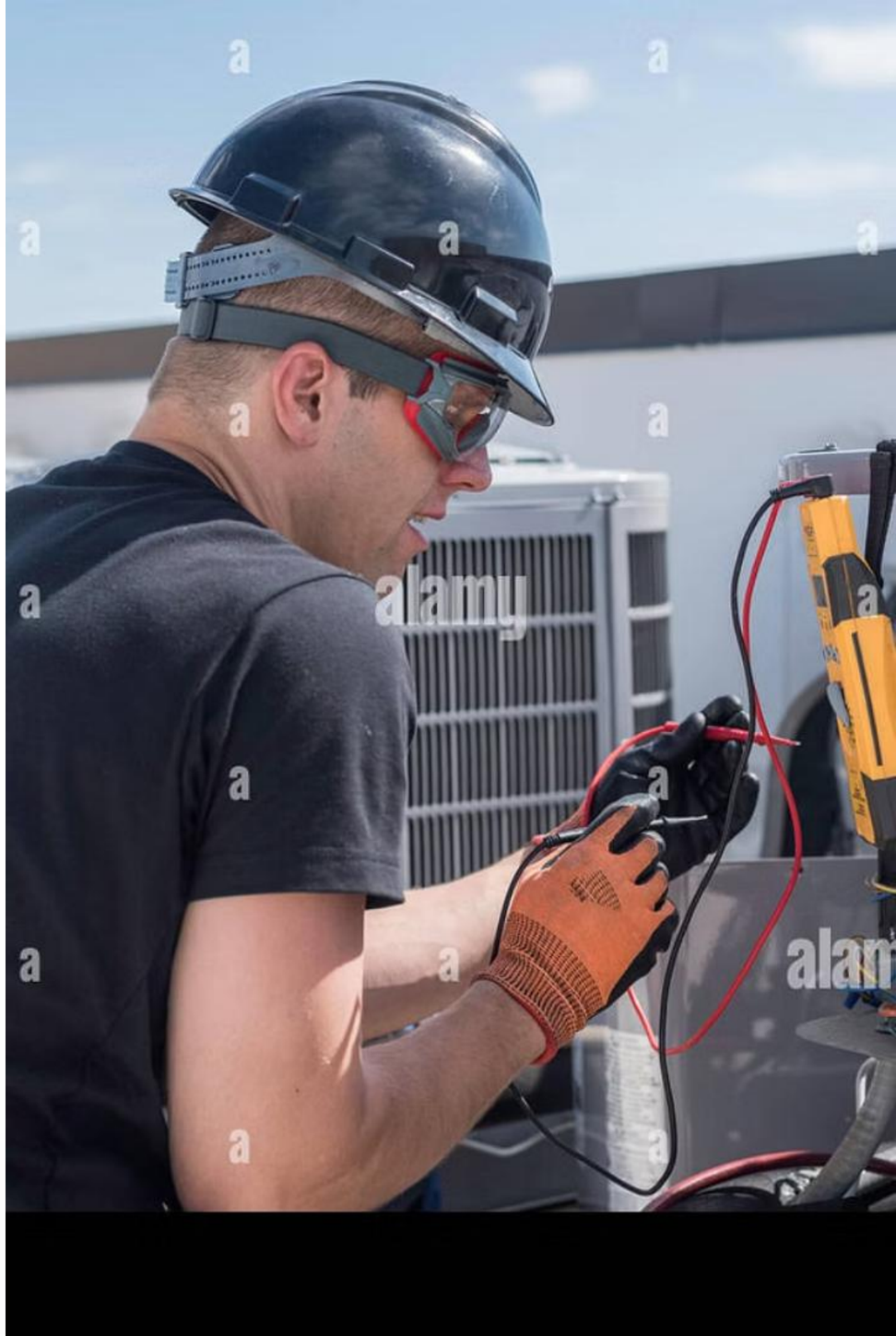
When working with or changing a cooling unit, never allow yourself to be cornered in a small area. Always have a means of exit.

Unit Integrity

Although cooling units are very stout, all it takes is one weak point (a deteriorated pipe, for example) to create a problem.

Emergency Response

If a cooling unit ruptures, stay away from the area and wait for the ammonia to dissipate. Call for assistance.



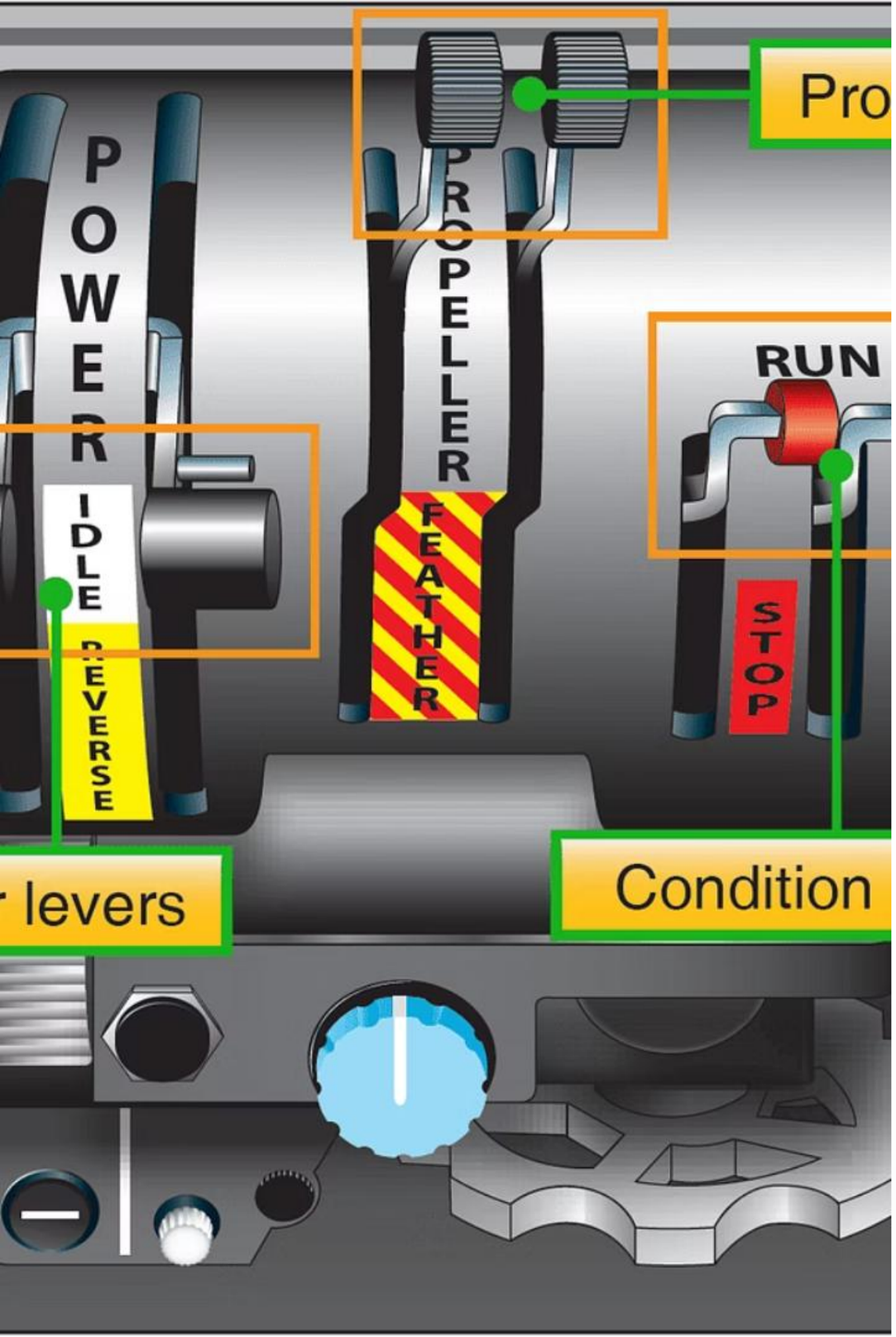
Three-Way Refrigerators

Definition

Three-way refrigerators are combination gas-electrical absorption refrigerators that operate on multiple power sources.

Power Sources

Heat source	That receives
120 V heater	Its current from a 120 V AC power supply
12 V heater	Its current from a battery
Gas burner	Gas from a propane tank or a natural gas supply line



Automatic Energy Selector System

120V Power Available

The refrigerator always selects 120V AC as the primary power source when available.

12V Power Conditions

If 120V is unavailable, the next power source is 12V, but only when the vehicle is running and batteries are being charged.

Propane Operation

If 120V is unavailable and conditions for 12V operation are not met, the refrigerator operates on propane.

The automatic energy selector (AES) system lets the circuit board in the refrigerator select the most appropriate available heat source.

Three-Way Refrigerator Safety

Dual Safety Requirements

For three-way refrigerators, you adhere to safety requirements for both electricity and gas.

Electrical Safety

When working with electricity, wear all protective equipment required for the application.

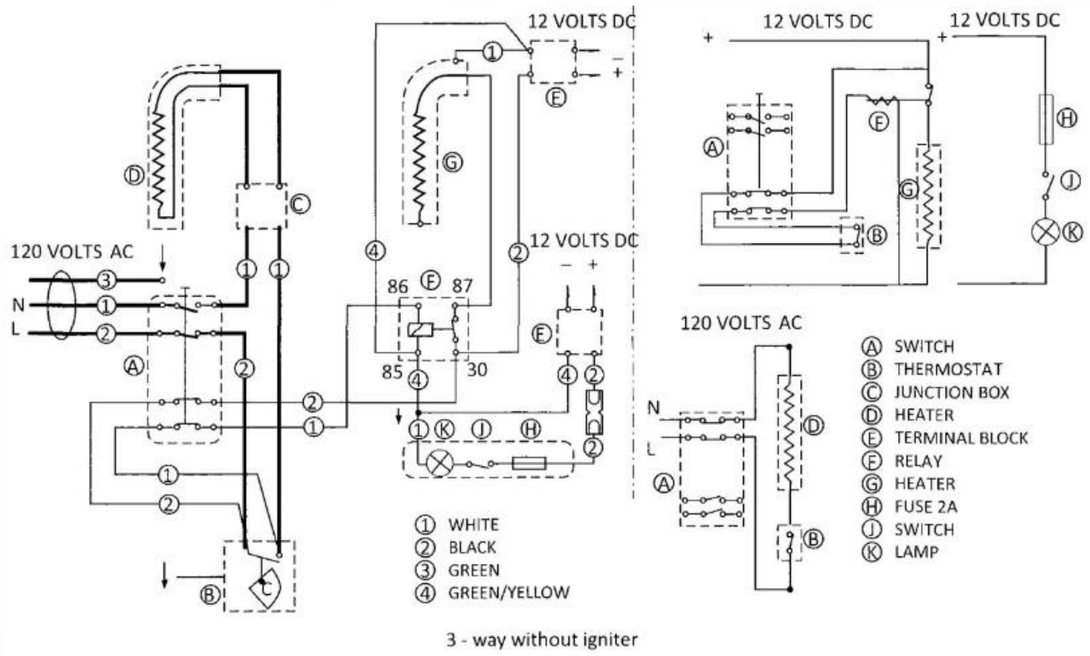
Gas Safety

Follow all standard gas safety protocols when working with the propane components of the system.

Wiring and Schematic Diagrams

Documentation

Manufacturer's literature for three-way refrigerators often includes wiring diagrams and schematics for installation and troubleshooting purposes.



Example of manufacturer's wiring diagram for an older three-way refrigerator

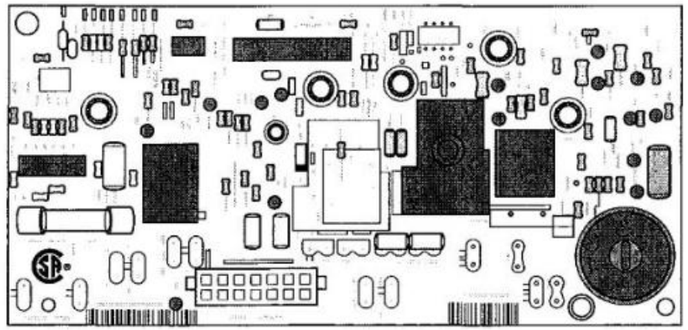
Electronic Control Boards

Function

This board is the gateway for voltage getting to the various components of the refrigerator. It controls inputs, outputs, monitoring, and diagnostic functions. Meanwhile, the power board manages and controls all functions.

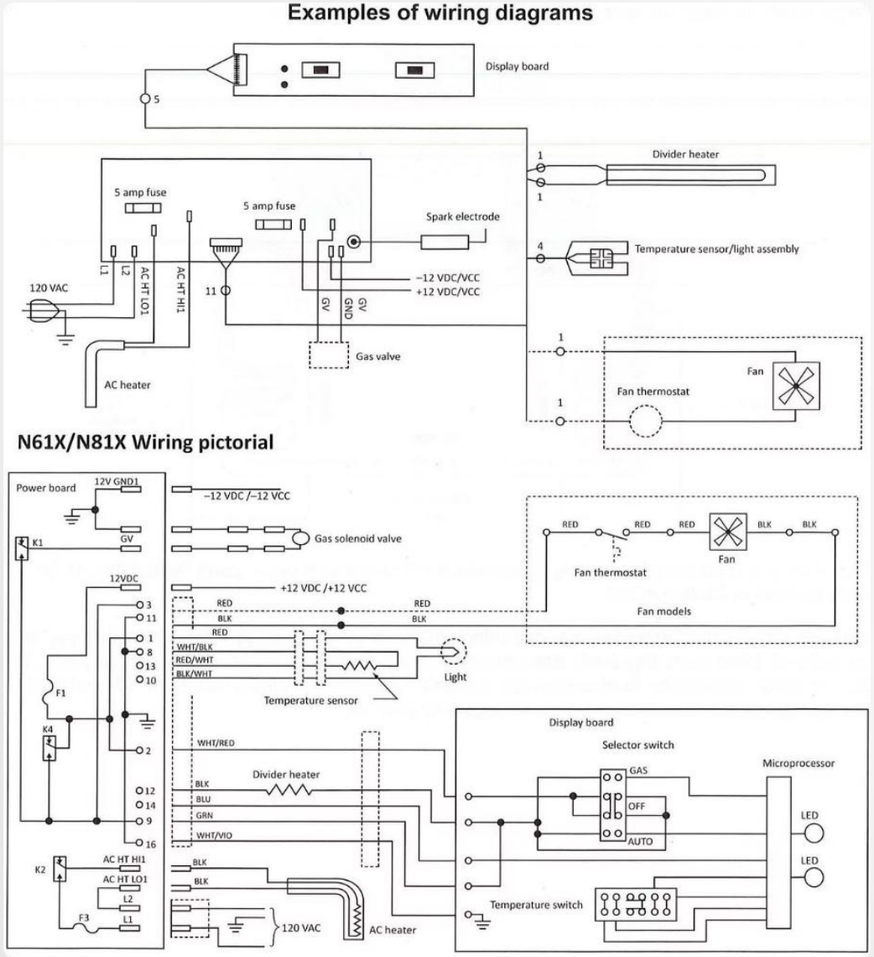
Communication

Inputs, outputs, monitoring information, and diagnostic functions are communicated through the optical control assembly. The wire harness interfacing the power board with the optical control assembly is "foamed" into the cabinet.



Modern Control Board Example

Modern electronic control boards integrate multiple functions into a single unit, providing more precise control and diagnostic capabilities than older mechanical systems. These boards often include microprocessors that can monitor multiple parameters simultaneously and adjust operation accordingly.



Gas Absorption Heat Pumps

Operating Principle

Gas absorption heat pumps (GAHPs) work on the same principles as the ammonia-water refrigerators with the addition of being reversible and serve as a heat source.

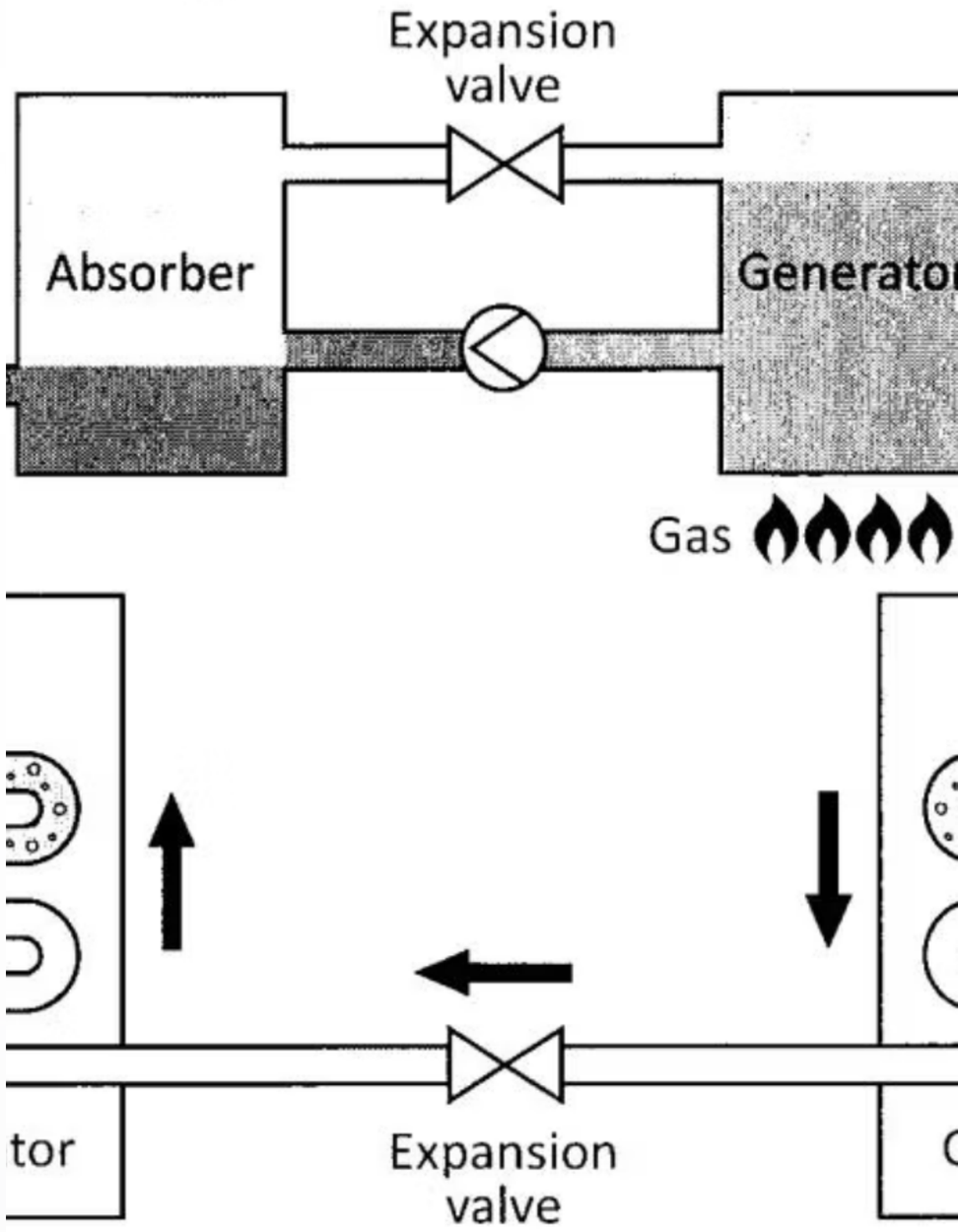
Heating Mode

When operating in heating mode (in winter), the appliance uses the absorption cooling cycle to recover heat from the outside environment, which, added to the heat produced by the combustion of natural/liquefied petroleum gas, is transferred into an exchanger and then into the environment to be heated.

GAHP Schematic

This simplified schematic shows how the heat output is used to supply low-temperature hot water for space heating similar to a traditional boiler.

Figure 1-11
GAHP heating cycle



GAHP Cooling Mode

Reversible Operation

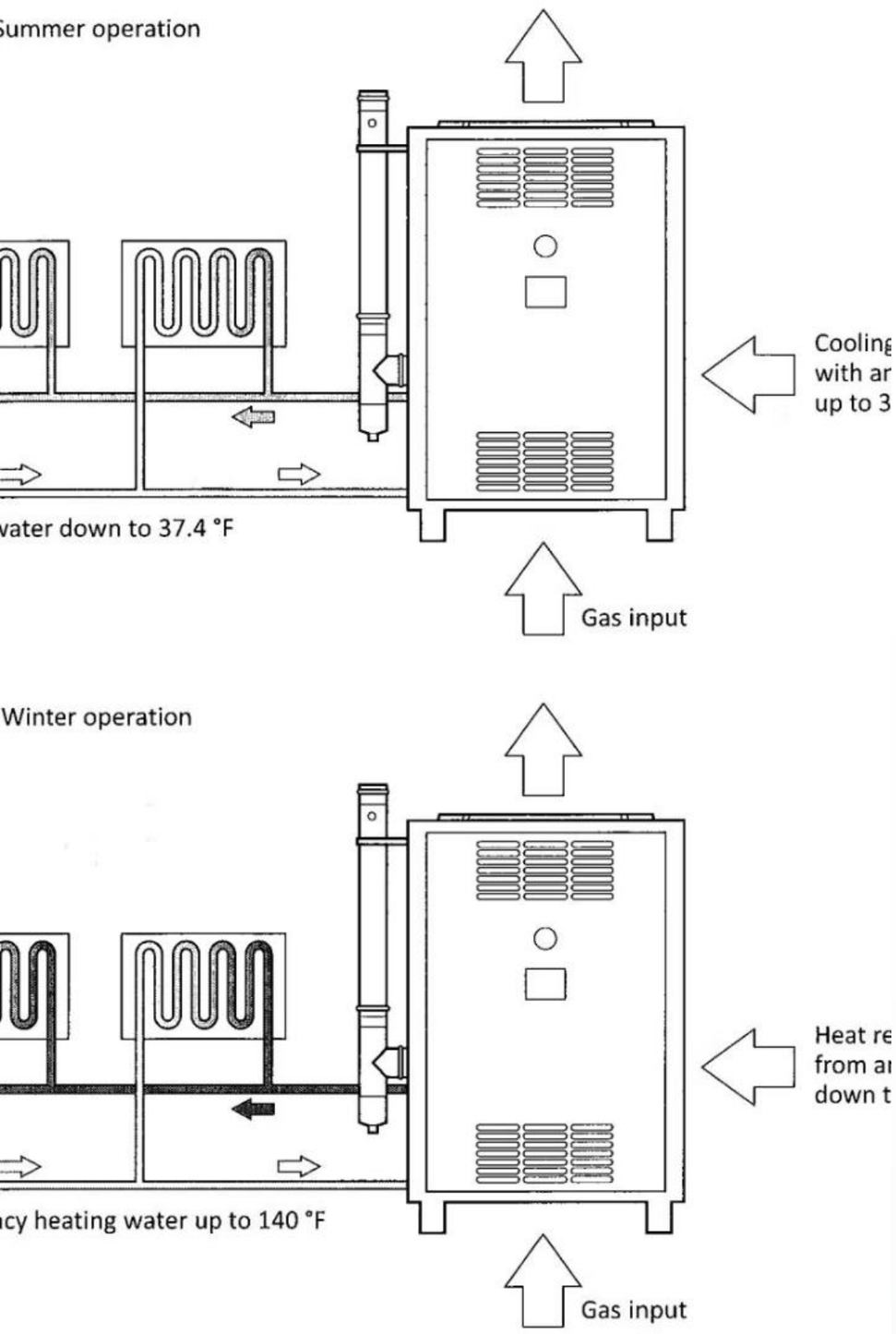
The same unit is suitable for cooling by reversing the absorption cycle using the outside air for heat rejection in cooling mode.

Efficiency Considerations

Although GAHPs tend to have lower operating efficiencies compared to electric heat pumps, they can achieve lower operating costs depending on the comparable costs of the energy sources.

System Type

In generic terms, absorption heat pumps are hydronic type systems (like a boiler that sits outside), as they heat and/or cool the water as required.



GAHP with Basic Hydronic System

This diagram shows a GAHP with a basic hydronic system. The system circulates water through the building to provide heating or cooling as needed.

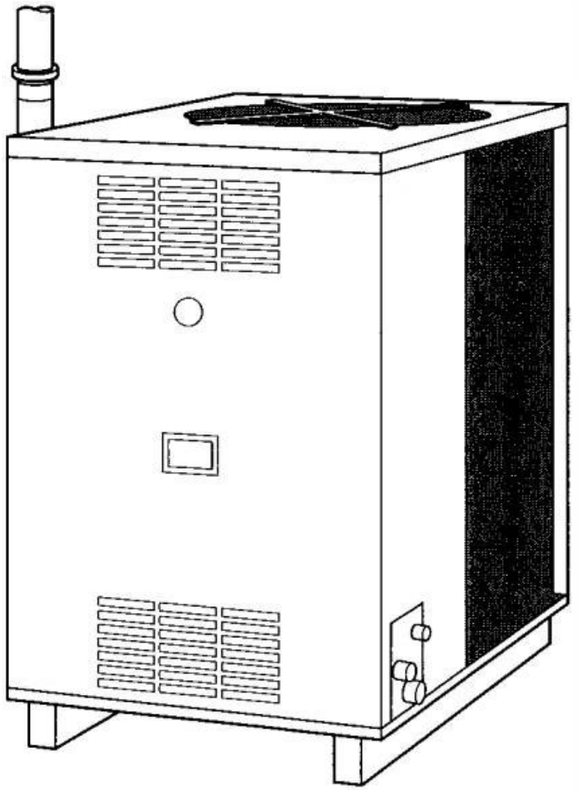
Compact Rooftop GAHP Unit

Specifications

A compact rooftop unit with a gas input of 95,000 Btu/h, a heating capacity of around 120,000 Btu/h, and a cooling capacity of nearly 60,000 Btu/h.

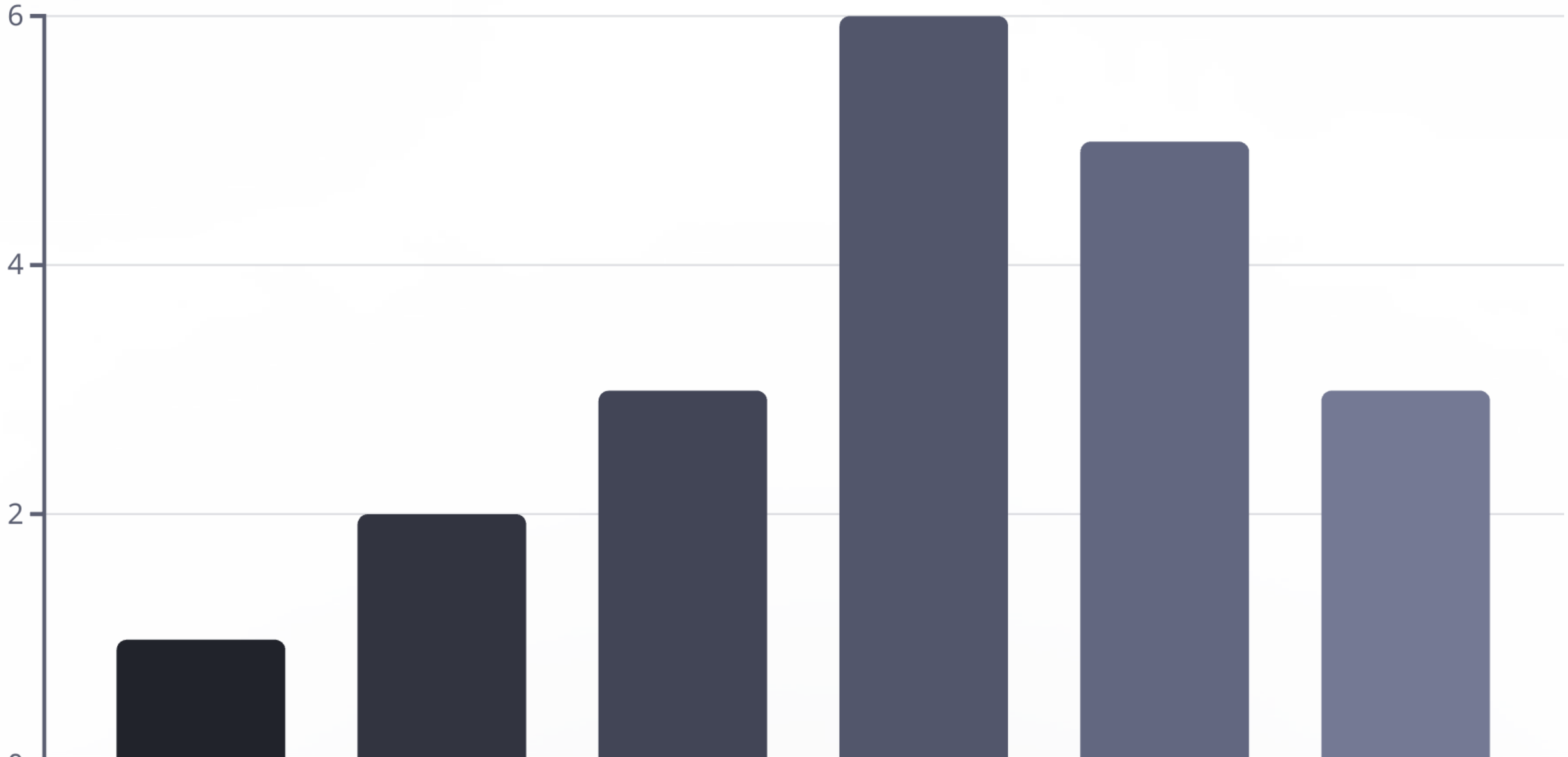
Applications

These units are ideal for commercial applications where both heating and cooling are required, and where gas is the preferred energy source.



Red Seal Alignment

The CSA Group Gas Trade Training Materials are aligned with the Red Seal program, ensuring that training meets national standards for gas technicians.



Absorption Refrigerator Advantages

Noiseless Operation

With no moving parts, absorption refrigerators operate silently, making them ideal for environments where noise is a concern.

Minimal Energy Requirements

Require only a small flame to operate, making them energy-efficient in certain applications.

Low Maintenance

Fewer moving parts means fewer components that can break down, resulting in potentially lower maintenance requirements.

Versatility

Can operate on multiple energy sources, making them ideal for RVs, cabins, and other locations where electricity may not always be available.

Thermal Mastic Application

Purpose

Thermal mastic is a heat transfer compound applied to the outside of the evaporator coils of the cooling unit at points where they make metal-to-metal contact with the freezer plate and fins of the refrigerator.

Importance

Thermal mastic greatly enhances the cooling ability of the unit and failure to use it will result in poor cooling.

Application

The mastic must be applied in a thin, even layer to ensure optimal heat transfer between components.

Leveling Requirements

Importance of Level Operation

The tubing in the evaporator section is specifically sloped to provide a continuous movement of liquid ammonia, flowing downward by gravity through this section.

Consequences of Unlevel Operation

If the refrigerator is operated when not level, liquid ammonia will accumulate in sections of the evaporator tubing. This will slow the circulation of hydrogen and ammonia gas, or in severe cases, completely block it, resulting in a loss of cooling.

Checking Level

Always use a proper level tool to ensure the refrigerator is installed correctly, especially in mobile applications like RVs and campers.

Flame Inspection and Adjustment

Regular Inspection

The flame should be inspected regularly to ensure proper combustion and efficient operation.

Ideal Flame Characteristics

A proper flame should be blue, hard, and low. If the flame appears yellow, soft, or elongated, this indicates a problem that needs to be addressed.

Adjustment Process

Flame adjustment should only be performed by qualified technicians following manufacturer specifications for gas pressure and burner configuration.

Burner Cleaning Procedure

Disconnect Power and Gas

Ensure all power sources are disconnected and the gas supply is turned off before beginning any maintenance.

Remove Burner Assembly

Carefully remove the burner assembly according to manufacturer instructions.

Clean Thoroughly

Use a stiff brass bristle brush to clean each opening in the burner mesh. Clean the burner venturi with pipe cleaners or with a venturi brush.

Reassemble and Test

Carefully reassemble all components and test for proper operation before returning to service.

Gas Pressure Testing

Importance

For most propane-fired refrigerators, the correct gas inlet pressure is 11 inches w.c. This appliance is probably the most sensitive when it comes to gas pressure; there is very little tolerance in the gas pressure before problems begin.

Testing Procedure

Use a manometer connected to the pressure tap to verify the gas pressure is within manufacturer specifications.

Adjustments

If pressure is not within specifications, adjustments should be made at the regulator, not at the appliance.

Troubleshooting: No Cooling

1 Check Leveling

Ensure the refrigerator is properly leveled. Unlevel operation can prevent proper circulation of refrigerant.

2 Verify Heat Source

Confirm that the heat source (gas flame, electric element) is operating correctly and providing sufficient heat to the generator.

3 Inspect Ventilation

Check that ventilation paths around the refrigerator are clear and unobstructed, allowing proper air circulation for the condenser.

4 Examine Burner and Orifice

Inspect the burner and orifice for cleanliness and proper operation. Clean or replace as necessary.

Troubleshooting: Yellow Flame

Identify Yellow Flame

A yellow, soft, elongated flame indicates improper combustion.

Clean Air Openings

Dust or lint present in the air is sucked in through the primary air openings and collects at the openings, changing the flame from blue to yellow.

Clean Orifice

Soak the orifice in non-oily solvents and then blow air through it. Never use sharp tools to clean the orifice.

Verify Improvement

After cleaning, the flame should return to a hard, low blue flame. If not, further troubleshooting is needed.

Troubleshooting: Electrode Issues

No Spark

If the piezo igniter fails to operate, the cause may be too great a distance between the electrode and the burner (the ideal is 2-3 mm distance).

Creepage

Electrical current may be following an unintended path due to moisture or contamination on insulating surfaces.

Poor Electrical Contact

Check all connections to ensure they are clean and secure. Wire leading to the electrodes should not have contact with any metal parts.

Installation Requirements

Proper Leveling

The refrigerator must be installed level to ensure proper operation of the cooling system.

Adequate Ventilation

Sufficient airflow must be provided around the refrigerator, especially at the back where the condenser and absorber are located.

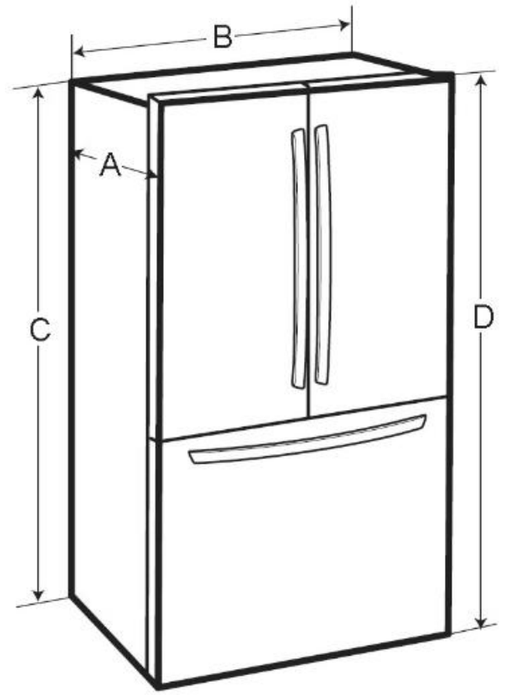
Clearances

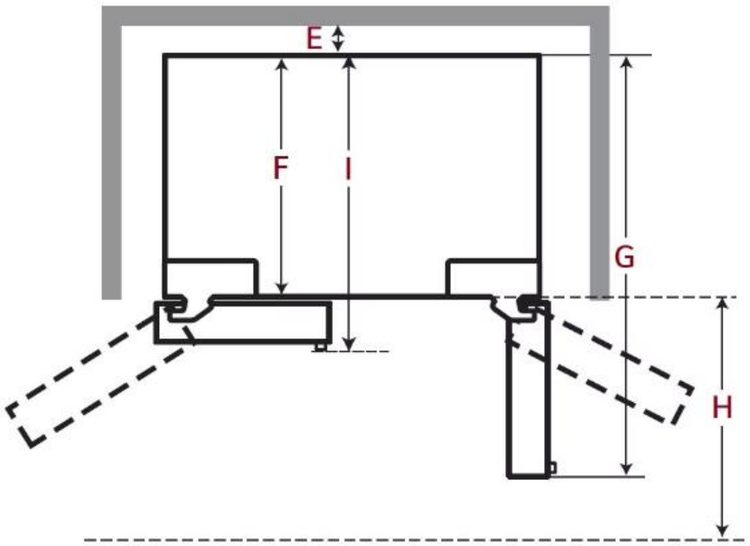
Maintain proper clearances from combustible materials as specified by the manufacturer.

Venting

For indoor installations, proper venting of combustion products is essential for safety.

DIMENSIONS / CLEARANCE





Venting Requirements

Code Requirements

Propane refrigerators installed in dwellings after the provincial adoption of the 2010 CSA B149.1 Code must be of a direct vented type.

Safety Purpose

Proper venting ensures that combustion products, including potentially dangerous carbon monoxide, are safely removed from the living space.

Installation Considerations

Venting must be installed according to manufacturer specifications and local codes to ensure safe and effective operation.

Maintenance Schedule

Monthly

Check flame appearance and refrigerator performance

Quarterly

Inspect ventilation paths and clear any obstructions

Annually

Clean burner with brass bristle brush and clean venturi with pipe cleaners

Bi-Annually

Professional inspection of all components and safety systems

Safety Equipment for Service

Eye Protection

Safety glasses or goggles to protect eyes from chemicals and debris

Hand Protection

Chemical-resistant gloves when handling refrigerants or cleaning agents

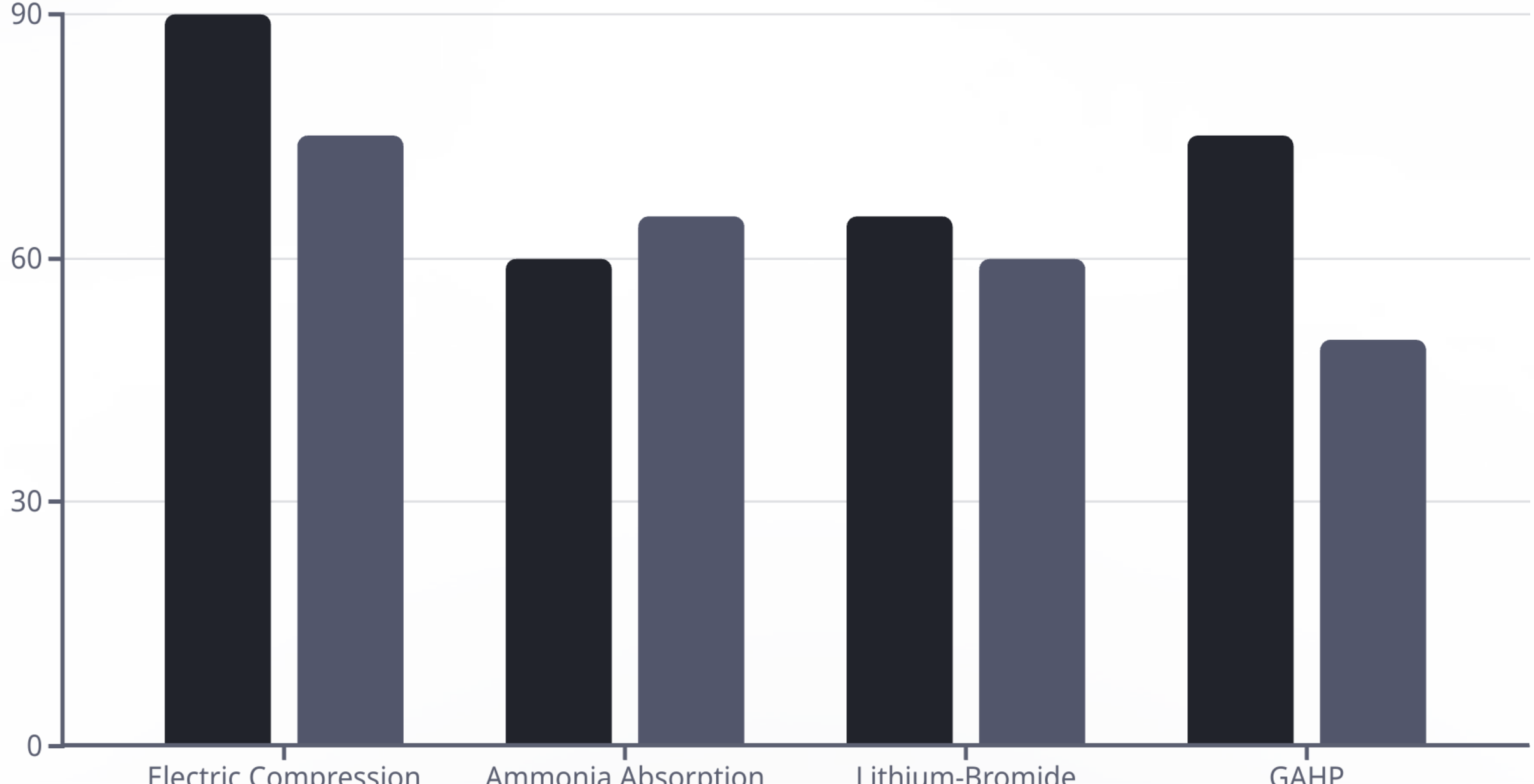
Respiratory Protection

Appropriate mask when working in areas with potential ammonia exposure

Fire Extinguisher

Accessible fire extinguisher rated for gas fires

Efficiency Comparison



Future Developments in Absorption Refrigeration

Improved Efficiency

Research into new materials and designs to increase thermal efficiency

Solar Integration

Combining absorption refrigeration with solar thermal collectors

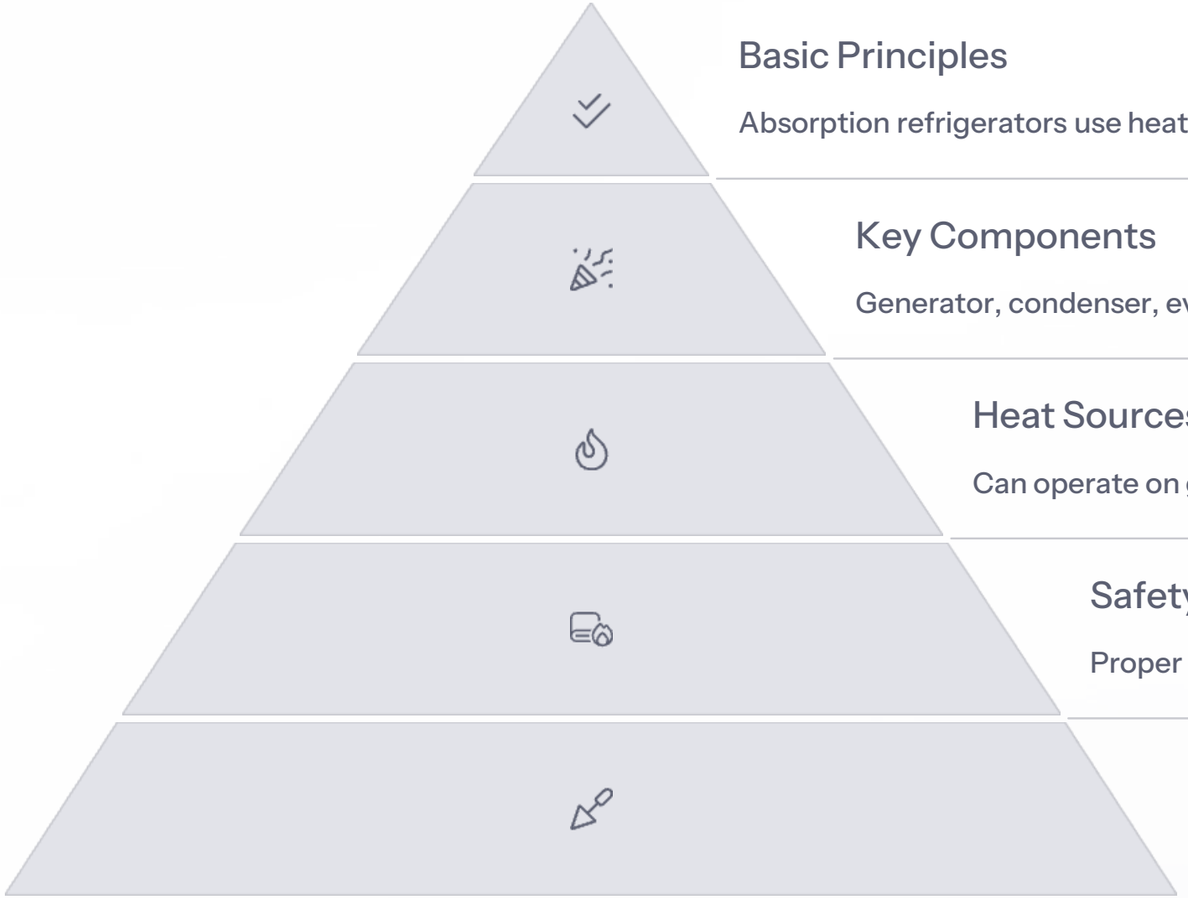
Eco-Friendly Refrigerants

Development of safer, more environmentally friendly refrigerants

Smart Controls

Advanced electronic controls for optimized performance

Summary of Key Points



Basic Principles

Absorption refrigerators use heat, refrigerant, and adsorbent to create cooling

Key Components

Generator, condenser, evaporator, and absorber work together in a sealed system

Heat Sources

Can operate on gas, 120V AC, or 12V DC depending on the model

Safety Considerations

Proper handling of refrigerants, correct installation, and regular maintenance

Maintenance

Regular cleaning of burners, checking flame quality, and ensuring proper leveling

CSA Unit 16

Chapter 2
Installation Procedures for Gas Refrigerators

This presentation covers the comprehensive installation procedures for gas refrigerators, including venting requirements, proper clearances, direct and non-direct ventilation methods, gas connections, and maintenance instructions. Understanding these procedures is essential for safe and efficient operation of gas-fired refrigeration systems.

Overview and Purpose

Purpose

To provide comprehensive installation guidelines for gas refrigerators

Safety

Ensure proper venting and installation to prevent hazards

Compliance

Follow provincial code requirements and manufacturer's instructions

Key Terminology

Condensation

The change of water from its gaseous form (water vapour) into liquid water

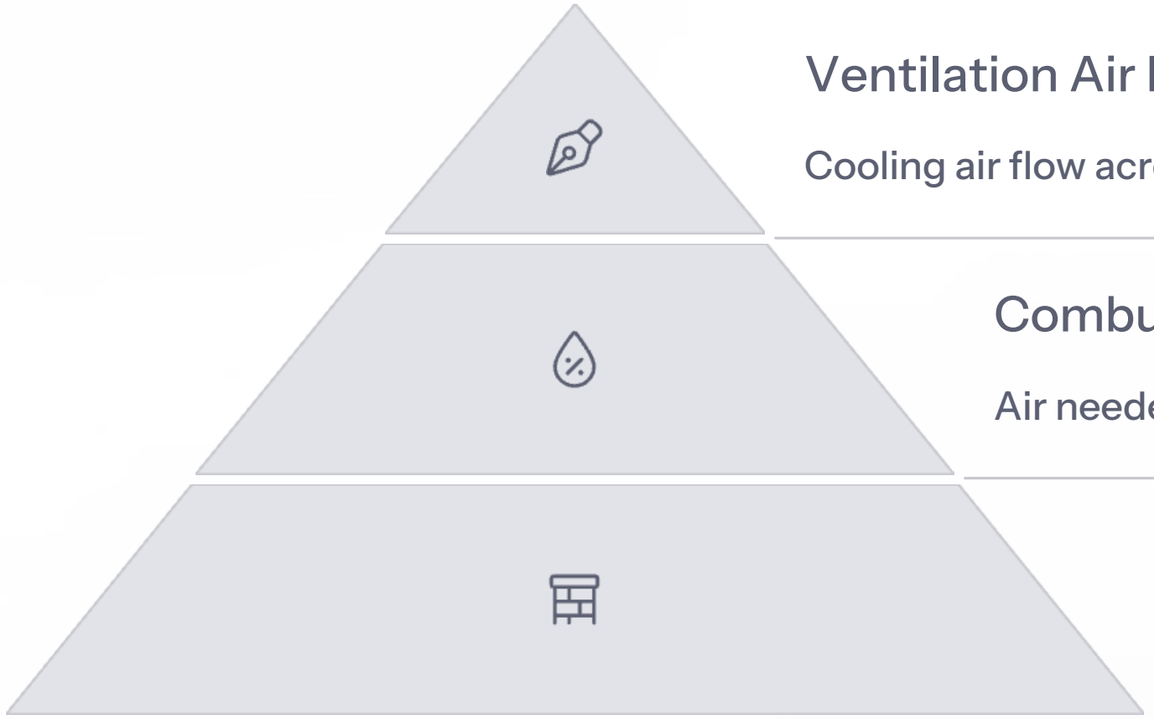
Separator plate

Prevents exhaust air from being channelled back into the fresh-air intake

Sealed combustion

System where combustion air is drawn from outside and exhaust gases are vented outside

Venting Requirements: Multiple Meanings



Ventilation Air Flow

Cooling air flow across fins for heat removal

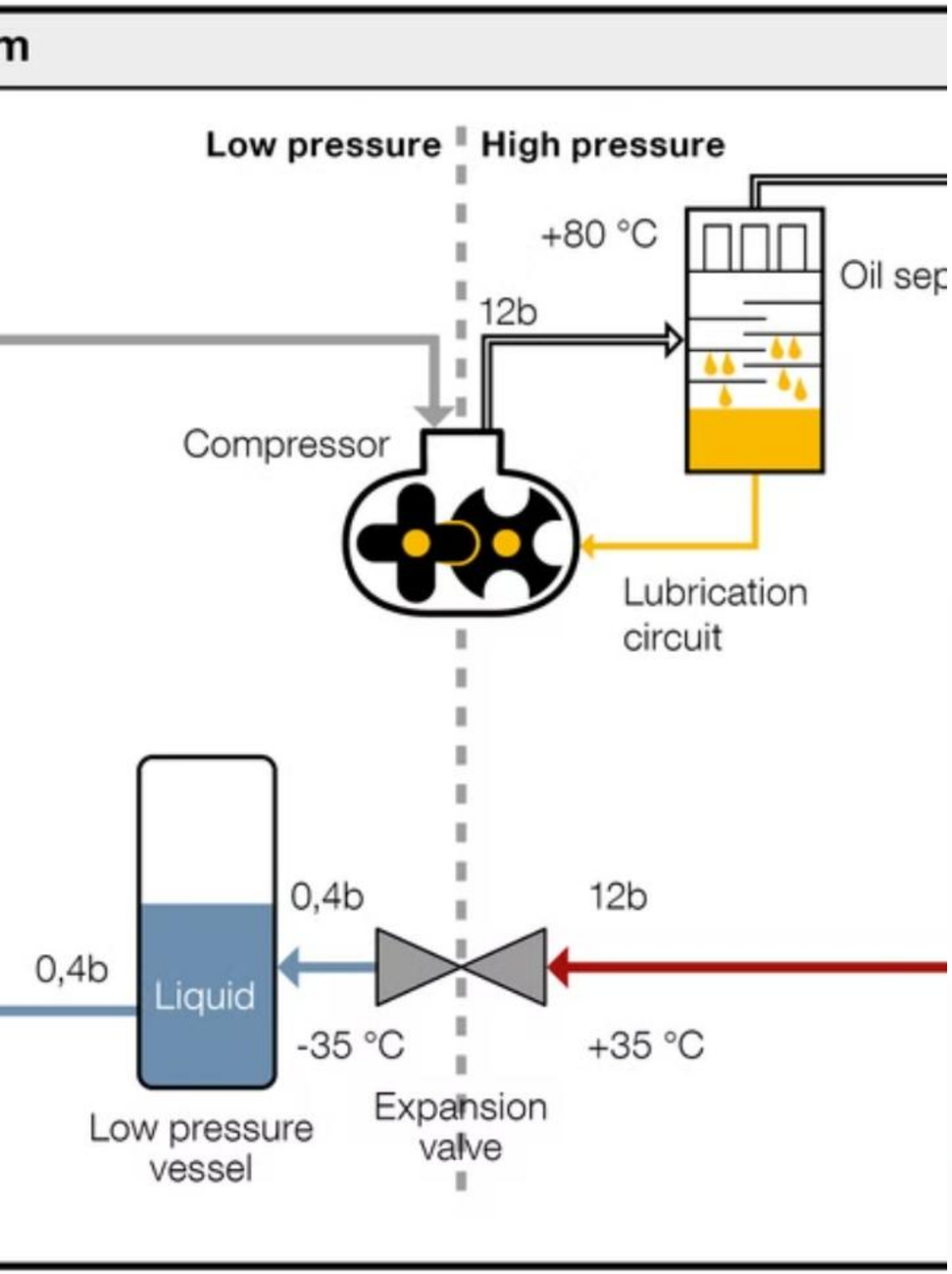
Combustion Air Supply

Air needed for proper gas burning

Exhaust Gas Venting

Removal of combustion byproducts to outside

In regard to gas refrigerator, the term venting has multiple meanings. To properly understand the venting requirement, it is necessary to understand the three different venting requirements of the refrigerator.



Ventilation (Cooling) Air Flow Process

Heat Release

Cooling unit gives off heat, warming surrounding air

Air Movement

Warm air rises, drawing cooler air from lower vent

Temperature Differential

Greater temperature difference creates faster air rise

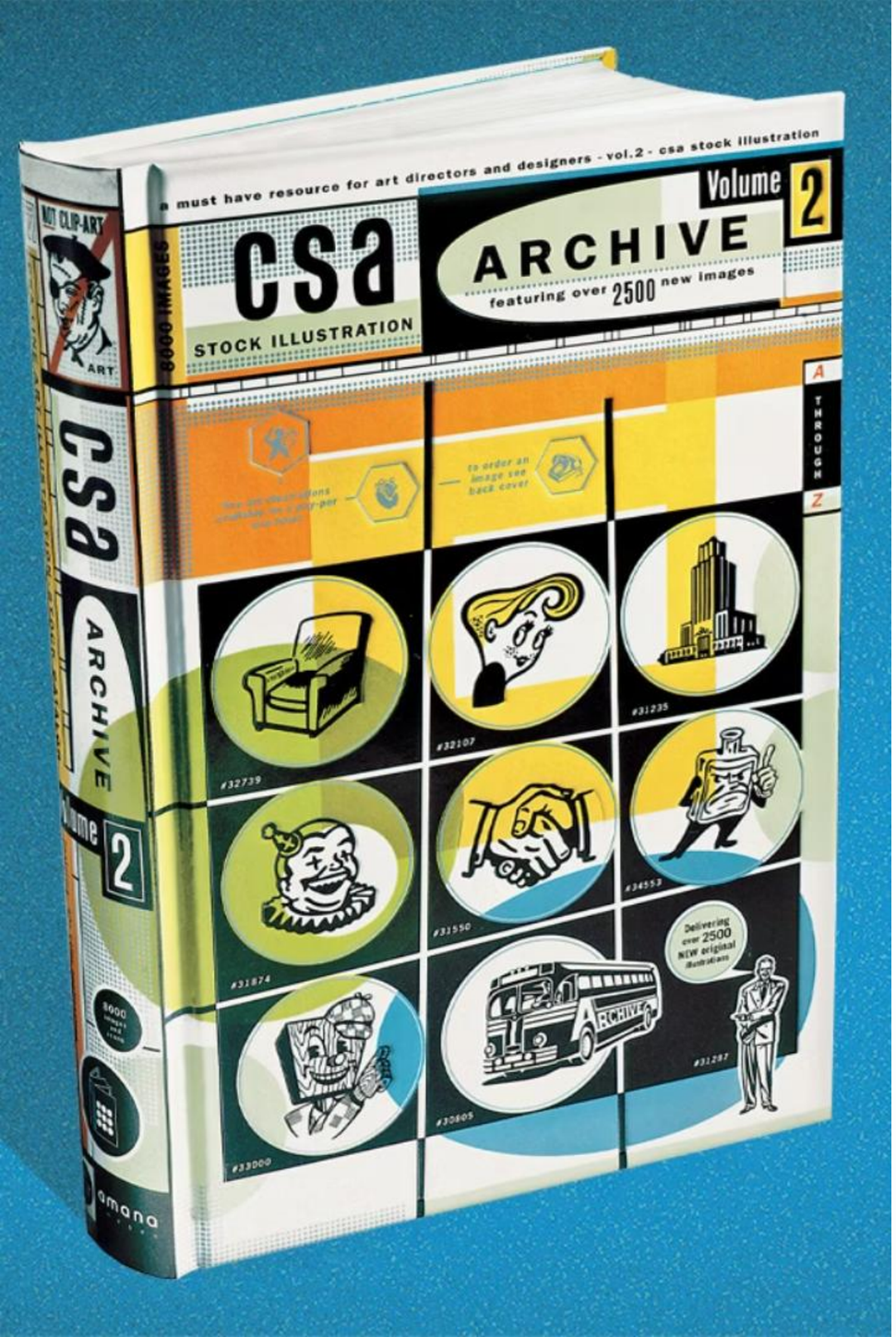
Forced Circulation

Air flow path forces cooler air through cooling unit coils as it rises

Critical Safety Warning

> Never install any gas appliance in an airtight structure or sleeping area without proper venting.

Gas technician/fitter must refer to and install gas-fired refrigerators strictly according to the provincial code requirements and the manufacturer's installation instructions.



CSA B149.1 Requirements for New Installations

Section 7.34.1: Minimum Clearances

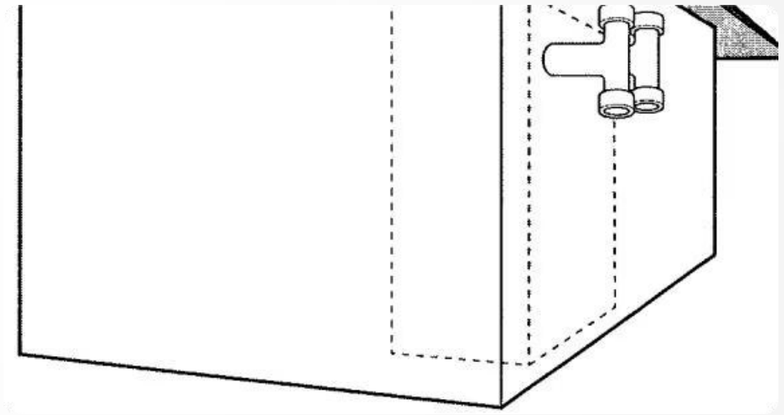
- Above: 12 in (300 mm)
- Back and sides: 2 in (50 mm)

Section 7.34.2: Dwelling Units

A refrigerator installed in a dwelling unit shall be of the direct-vent type.

Section 7.34.3: Unvented Refrigerators

An unvented refrigerator shall be installed in an area that is not normally occupied and does not directly communicate with occupied areas.



Direct Vent Installation Requirements

Location Requirement

A direct vent propane fridge will need to be located/installed on an outside wall.

Unvented Models

For use in areas such as shops, sheds, screened porches, and other open areas

Safety Equipment

Must come equipped with a carbon monoxide (CO) alarm with safety shut-off

Non-Direct Ventilation Improvement Options

Follow Manufacturer's Instructions

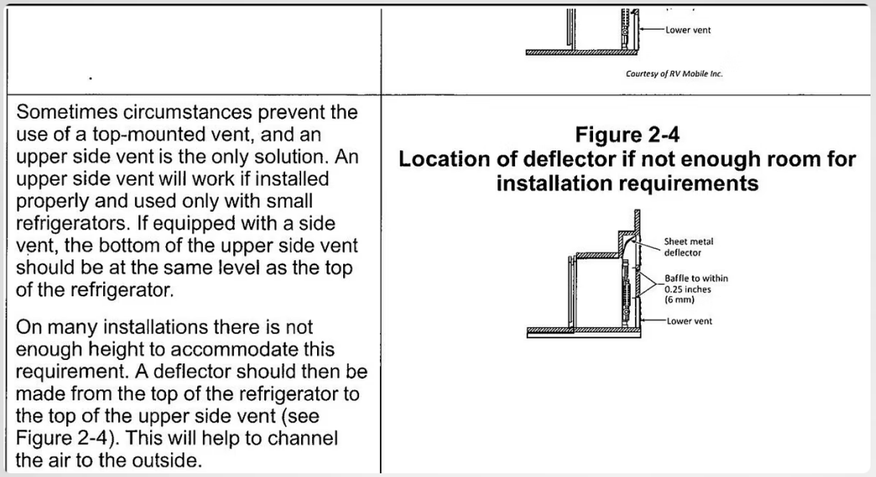
Always refer to and follow the manufacturer's certified installation instructions

Maintain Proper Clearances

Ensure recommended clearance on sides and top of fridge

Optimize Air Flow

Any more than 1 inch (25 mm) clearance means the draft may bypass the condenser fins



Proper Clearances for Venting

Figure 2-2 shows the proper clearances required for effective venting of a gas refrigerator. The roof vent should have a maximum of 1 inch clearance to ensure proper air flow across the condenser fins.

Roof Vent Installation

Purpose

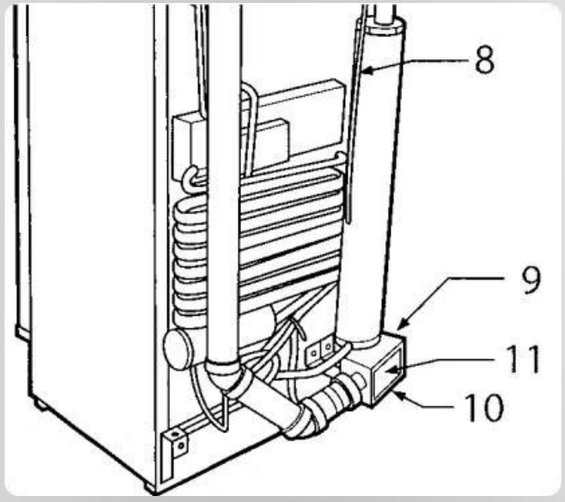
The roof vent caps off the venting system and allows for good air flow

Positioning

Centered over the cooling unit

Sizing

At least as long as the cooling unit is wide

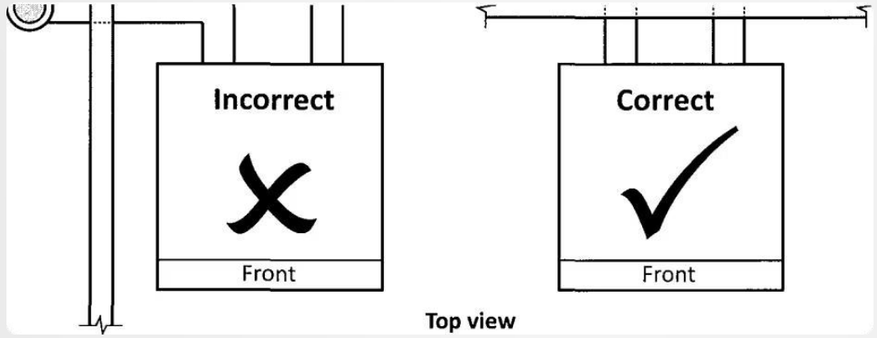


Direct Vented Models Overview

Direct vent (DV) appliances are often referred to as sealed combustion appliances. These systems provide improved safety and efficiency by isolating the combustion process from the living space.

Direct Vent Components

Part#	Description
1	Fresh air assembly
2	Chimney Bracket
3	Fresh air assembly
4	(Not Pictured)
5	Exhaust vent assembly
6, 7	Insulated chimney
8	Condensate hose
9, 10, 11	Burner box components



Direct Vent Installation Guidelines

Vent Direction

Never vent to the side of the appliance. Vents must terminate directly from the back of the refrigerator.

Follow Instructions

Direct vent refrigerator must be installed in accordance with the manufacturer's instructions

Vent Termination Location

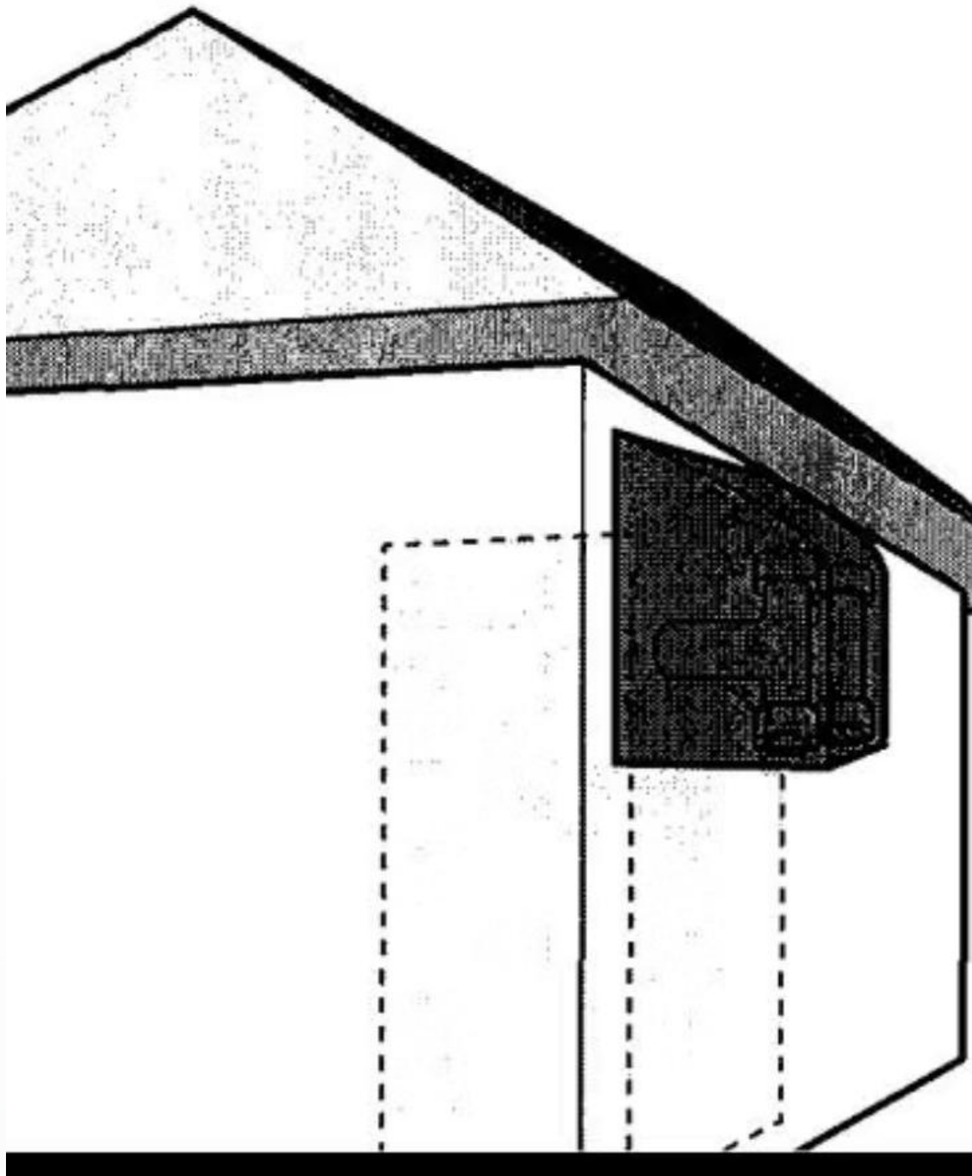
Sheltered Location

It is best to terminate the hood vents in a sheltered location not affected by high winds

High Wind Areas

If not sheltered, use the manufacturer's high wind termination hood

Figure 2-7
/ high wind installation



Sealed Combustion Section Components

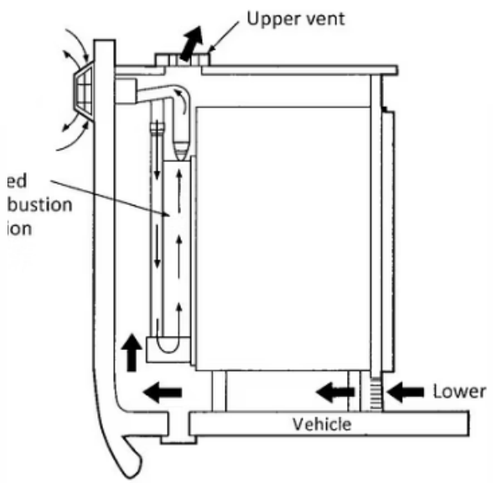
Sealed Combustion Components

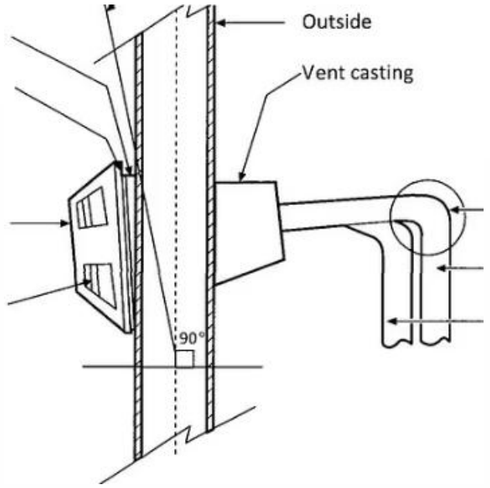
The sealed combustion section consists of two flex tubes, which link the burner assembly to the outside vent housing:

- The larger flex tube is a fresh air intake which feeds outside air directly to the burner
- The smaller flex tube is the exhaust tube, which is used to dissipate the products of combustion from the boiler tube

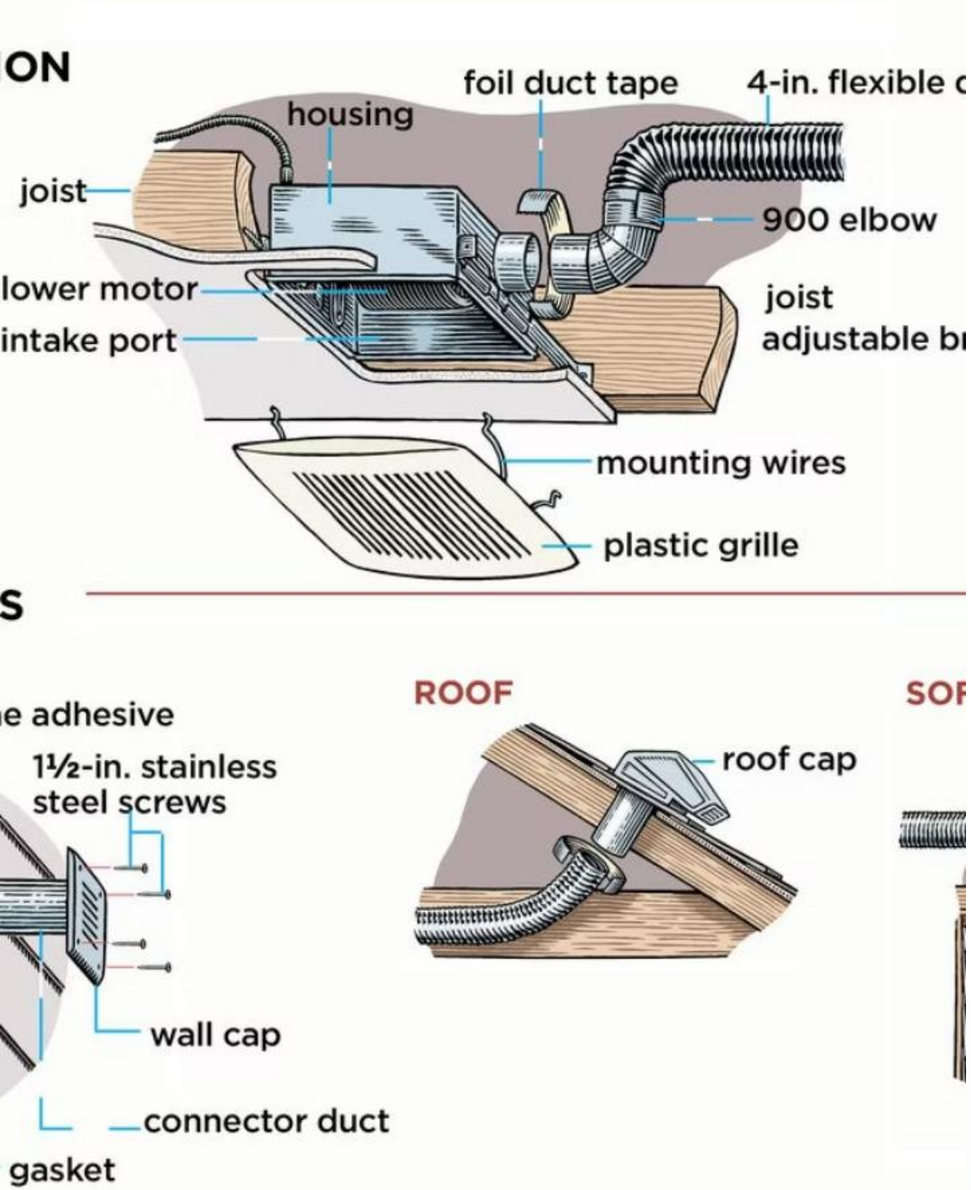
Figure 2-8
Sealed combustion vent requirements

Dometic Refrigerator Components





Courtesy of Dometic Corporation



Vent Housing Installation

Proper Angle

The vent housing must not follow the contour of the van; it must be less than 90° to the ground

Condensation Management

This angling allows the condensation to flow out of the housing

Separator Plate

Some manufacturers design vent housings to include a separator plate that prevents exhaust air from being channelled back into the fresh-air intake

Mobile Home and RV Installation Requirements

Compliance Standard

A refrigerator installed in a mobile home or recreational vehicle must comply with CSA Z240.4.1

Safety Requirement

Keep the appliance free from combustible materials, gasoline, and other flammable vapours and liquids

Gas Connection Requirements

Connection Type

Usually made to be connected with a 3/8 inch (10 mm) copper tube free from sharp corners and curves

Mounting

Mounted on the conical coupling connected to the manual shut-off valve

Placement

Feed pipe must be placed to avoid damage when the refrigerator is removed from its compartment

Additional Gas Connection Guidelines

Pressure Check

When connecting the refrigerator to the gas supply, check the required pressure as marked on the appliance rating plate

Direct Connection Warning

Never connect a propane gas cylinder directly to the refrigerator without a regulator

Leak Testing

Check the sealing of all joints using an approved leak detection solution

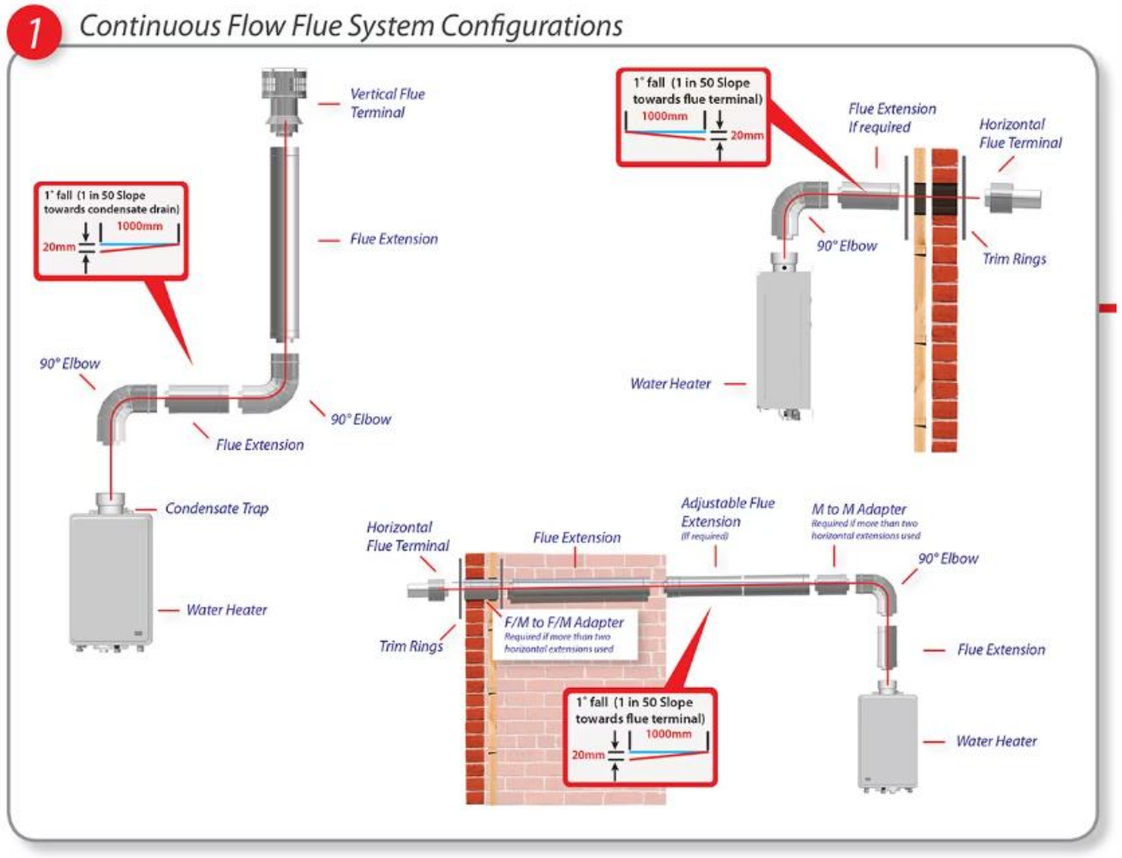
Flue and Ventilation System

Flue Function

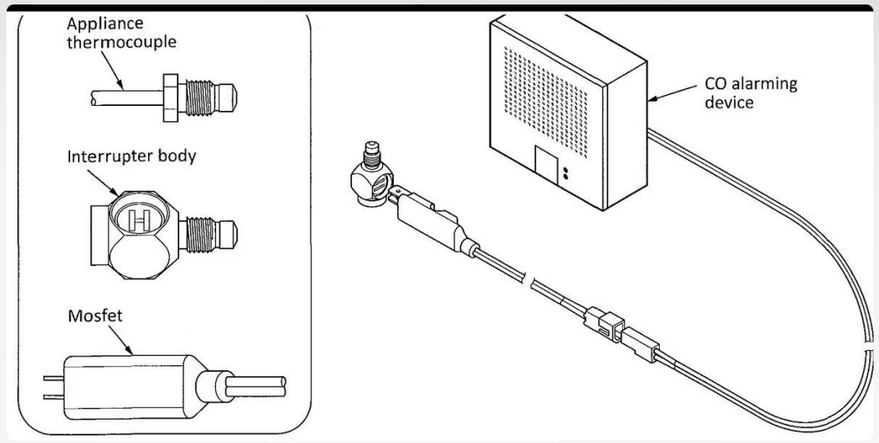
The flue directs hot gases around and away from the generating unit. Proper flue function is essential for refrigerator operation.

Common Restrictions

- Placing the refrigerator too close to the wall
- Placing objects over the opening
- Having some obstruction fall into it



Keep the flue clean to ensure proper functioning of the refrigerator. You can find the procedure for cleaning the flue in Unit 16 Domestic gas-fired refrigerators, Chapter 3. Maintenance and servicing.



Refrigerator Controls

The control panel of a gas refrigerator typically includes temperature settings, ignition controls, and safety features. Understanding these controls is essential for proper operation and troubleshooting.

Installation Procedure Overview

Follow Manufacturer's Instructions

CSA B149.1 and CSA B149.2 require that every refrigerator be installed according to the installation and operating instructions for the specific equipment

Determine Location

Consider appropriate location and installation requirements

Prepare Utilities

Set up gas supply and electrical according to code and authority having jurisdiction (AHJ)

Installation Step 1: Location and Preparation

Read Instructions

Read the installation and operating instructions thoroughly

Prepare Utilities

Prepare the gas supply and electrical according to the code and authority having jurisdiction (AHJ) in the area

Verify Clearances

Ensure proper clearances from combustible materials as specified in the code

Installation Step 2: Initial Testing Period

30-Minute Test Period

Allow for a 30-minute initial operation period to check for proper function

Leak Testing

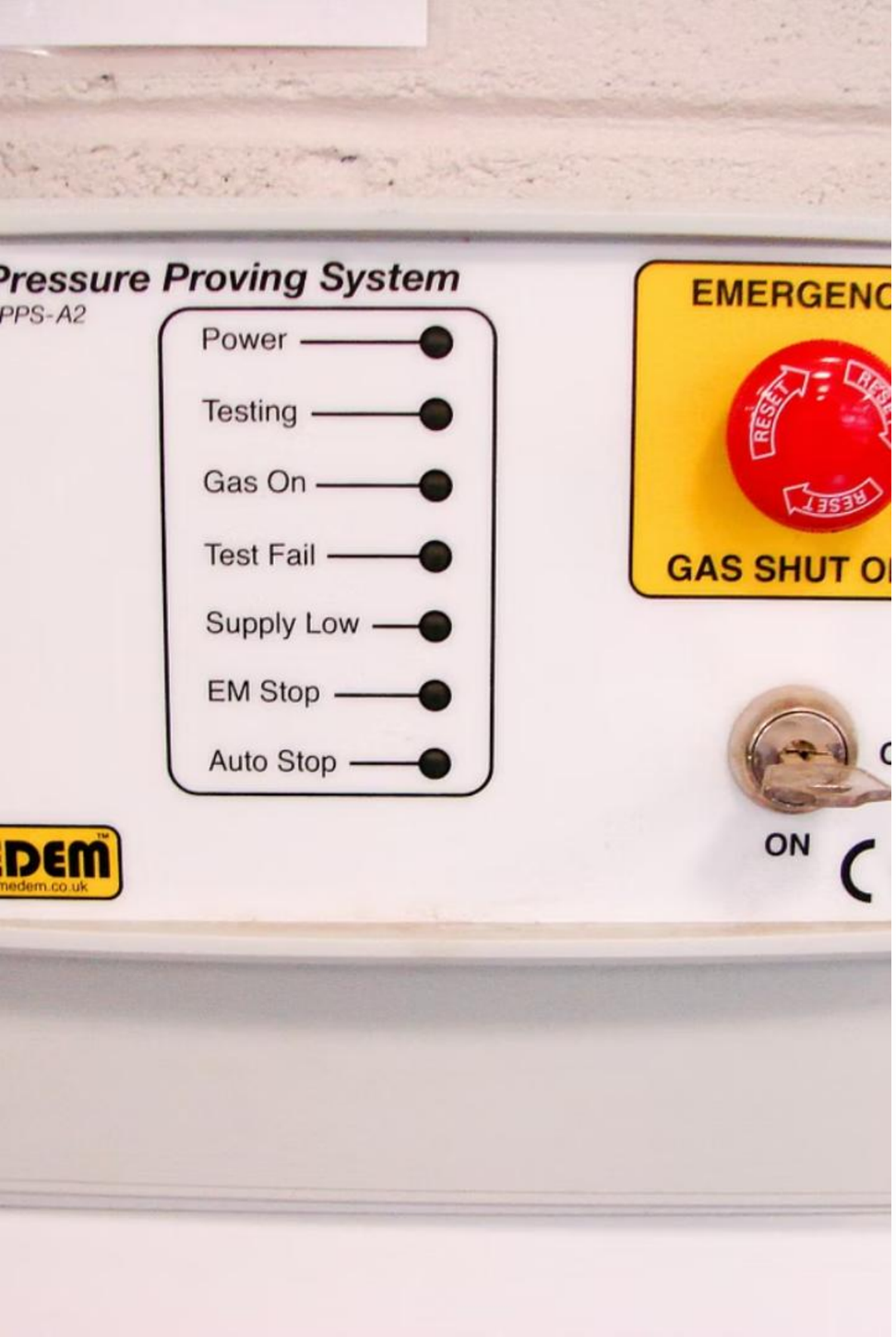
Check the connections for leaks using a detergent and water solution

Connection Inspection

Inspect from the gas inlet to the orifice spud

Installation Step 3: Pressure Gauge Reading

Condition	Pressure Requirement
If the appliance is operating singly on the line	The operating pressure should not be higher than 11 inches w.c. (2.75 kPa)
Other appliances are on the same line	The pressure should not fall below 10 inches w.c. (2.5 kPa)



Installation Steps 4-6: Safety and Completion

Test Safety System

Test the liquefied petroleum gas safety shut-off system in accordance with the manufacturer's instructions

Turn Off Gas

Turn off the gas at the control leaving the manual shut-off valve open

Replace Components

Replace the plug on the thermostatic valve

Installation Steps 7-9: Final Installation

Replace Burner Box

Reinstall the burner box assembly

Position Refrigerator

Install the refrigerator in the selected location, making sure that the flexible connector does not kink

Set Operation

Set the refrigerator to normal operation

Customer Instructions: Key Points

Owner's Manual

Encourage the customer to read the owner's manual completely

Noiseless Operation

Notify the customer that, unlike the compressor refrigerator, the operation of an absorption refrigerator is noiseless and therefore they will not be able to tell whether it is working by sound

Defrosting Variations

The interval between defrosting can vary considerably, depending on the climate and the extent of use

Modern Defrosting Systems

Automatic Defrost

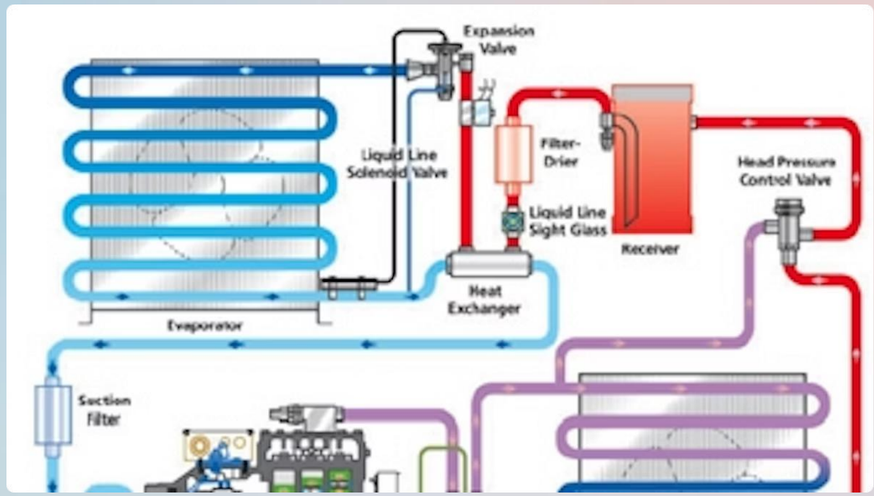
Most new designs incorporate an automatic defrost, whereby the refrigerator periodically runs through the defrost cycle as required by the control system

Manual Defrost

Some models still require manual defrosting according to manufacturer's instructions

Manufacturer's Instructions

Always refer to the manufacturer's instructions on the defrosting procedure



Manual Defrosting Procedure: Main Compartment

Remove Food

Remove food from the main compartment or from the freezer

Set Thermostat

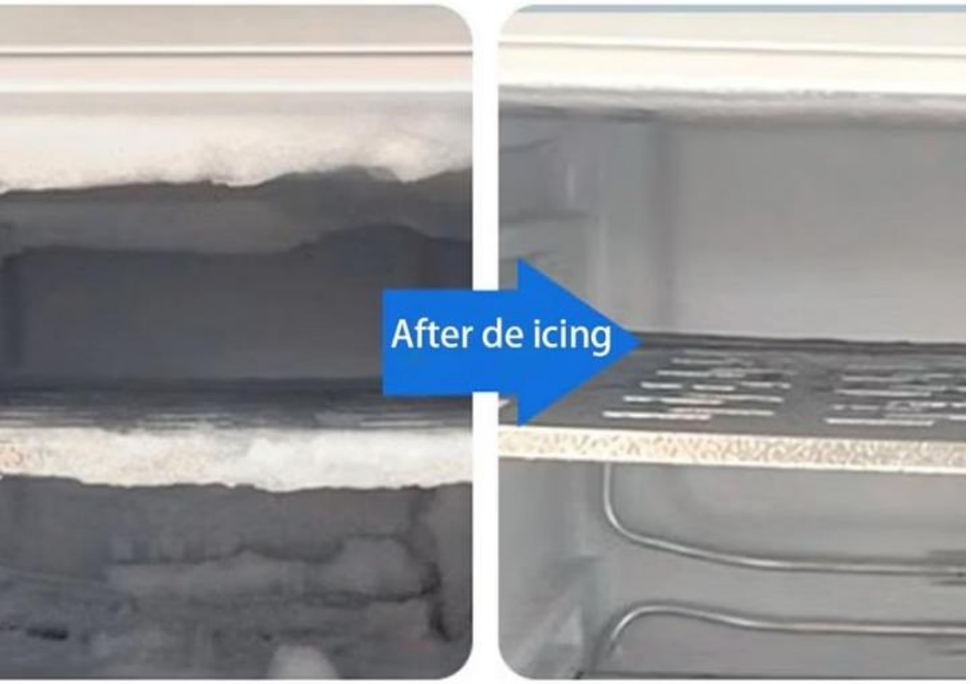
Set the thermostat knob to the defrost position

Wait Period

Leave the unit for approximately 2 hours

Low Flame Operation

The refrigerator continues to work on a low flame to provide refrigeration for the freezer



Manual Defrosting Procedure: Continued

Melting Process

The ice on the fins melts and runs through a drain to the rear of the refrigerator and into small containers where it evaporates

Inspection

Check the fins to make sure they are free of ice

Reset Thermostat

Adjust the thermostat to its usual setting

Freezer Defrosting Procedure

Turn Off Gas

Turn off the gas at the selector and remove all the food

Remove Components

Remove all the loose components from the refrigerator (such as racks, drawers, etc., including the batteries for lights)

Position Drip Pan

Turn the drip pan around so that the drain hole is towards the front and place a suitable container under it to catch the runoff of melting ice

6.5*11.5cm

t:48g

Freezer Defrosting: Final Steps

1 **Use Scraper**

Use the plastic scraper to remove ice as it melts

Leave Door Open

Leave the doors open until all the ice has melted, and then remove the container

Reset Drip Tray

Return the drip tray to its normal position

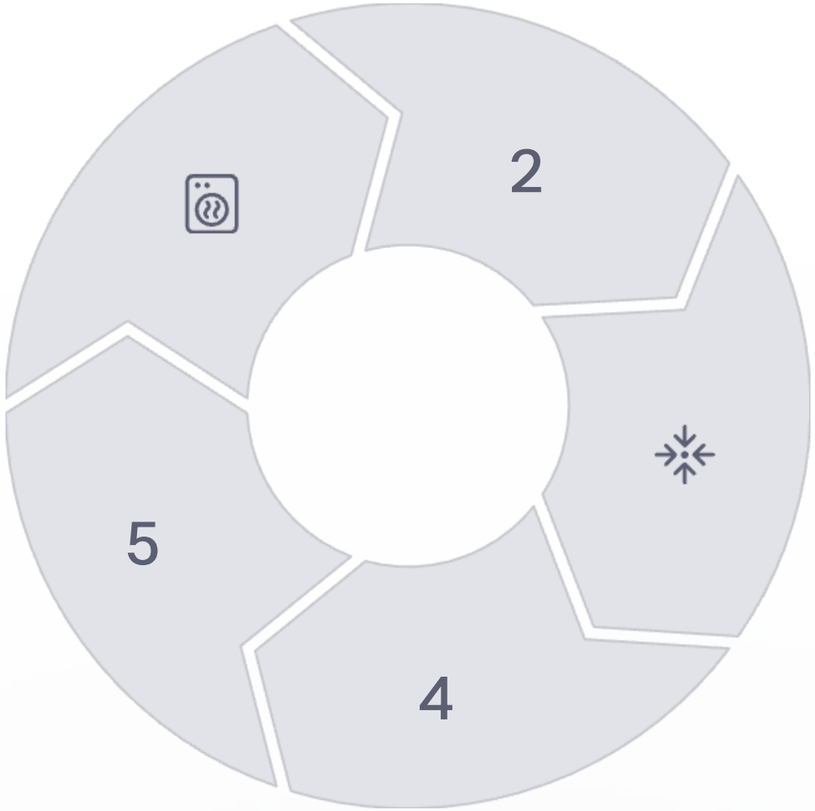
Understanding Absorption Refrigeration

Heat Application

Heat source (gas flame) applied to generator

Absorption

Ammonia reabsorbed into water solution



Refrigerant Separation

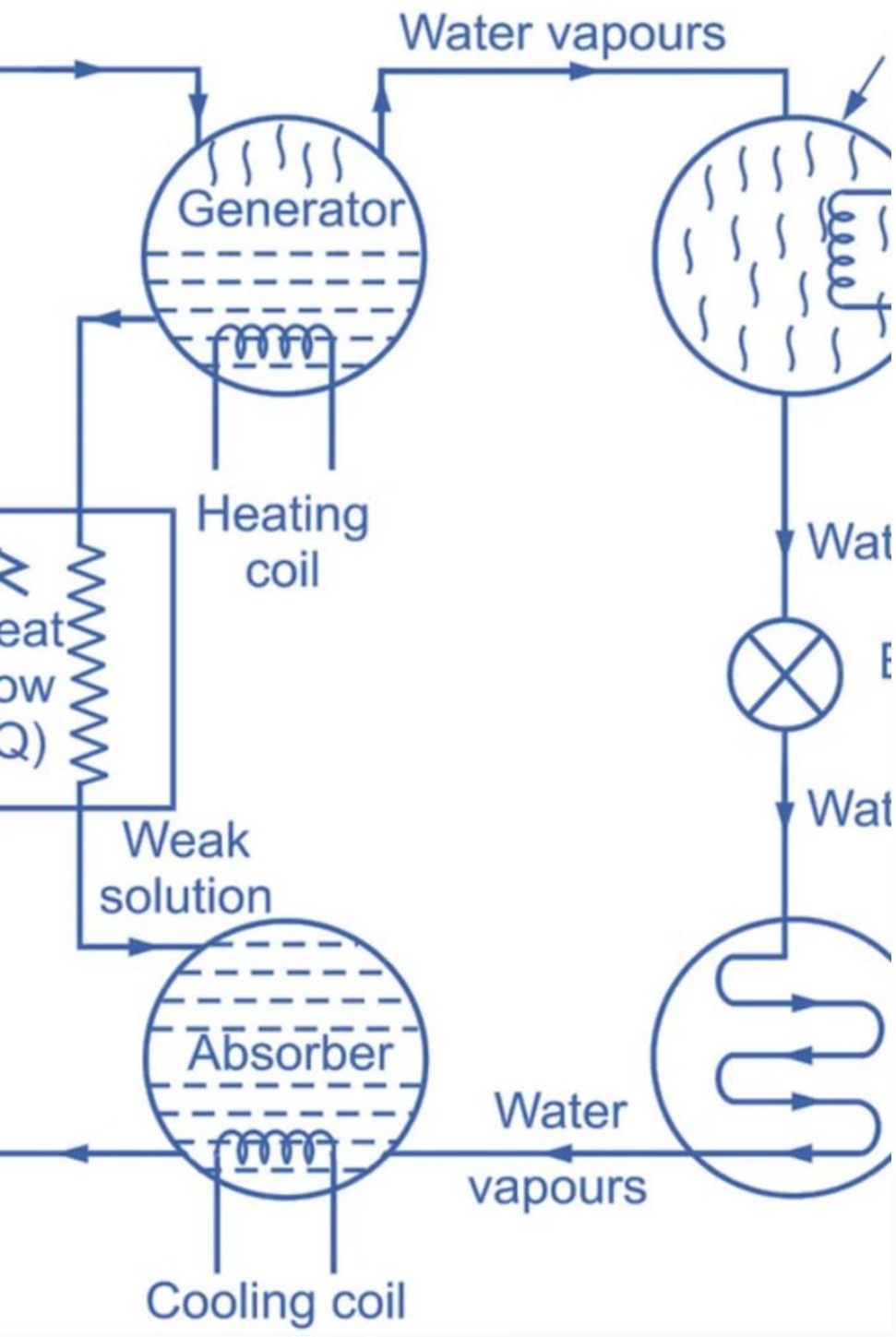
Ammonia separates from water solution

Condensation

Ammonia vapor condenses to liquid

Evaporation

Liquid ammonia evaporates, creating cooling effect



Importance of Proper Heat Dissipation

Critical Function

The evaporator in an absorption refrigerator needs to dissipate the heat it absorbs from the refrigerant

Proper Venting Requirement

It is essential that proper venting occurs behind the refrigerator

Consequence of Poor Venting

If the heat is not dissipated away from the condenser, the ammonia will not be able to liquefy; thus, no cooling will take place

Direct Vent vs. Non-Direct Vent Models

Direct Vent Models

- Required for dwelling units
- Sealed combustion system
- Must be installed on outside wall
- Improved safety features
- Separate air intake and exhaust

Non-Direct Vent Models

- Only for non-occupied areas
- Requires more careful installation
- Needs CO alarm with safety shut-off
- More ventilation considerations
- Typically used in open areas like porches

Sealed Combustion System Benefits

Enhanced Safety

Isolates combustion process from living space

Improved Efficiency

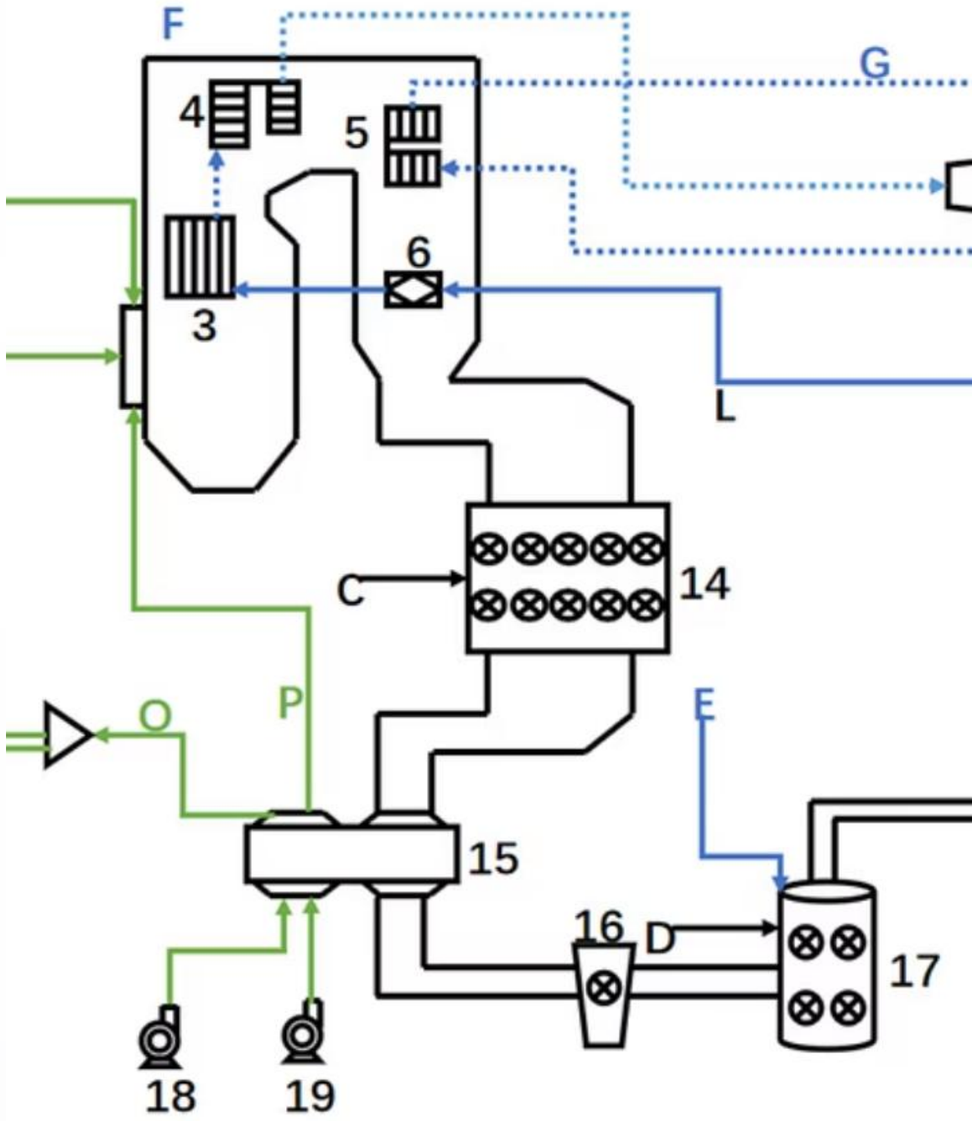
Direct air supply and exhaust paths optimize combustion

Indoor Air Quality

Prevents combustion byproducts from entering living space

Code Compliance

Meets requirements for installation in dwelling units



e; E.water; F.superheated steam; G.reheat steam; H.high-pressu
ulating water; L.feedwater;N.smoke extraction;O.one-off wind;P.

4.overheater;5.reheater;6.economizer;7.high-pressure cylind
heater;12.feed pump;13.condenser;14.denitrification unit;15.ai

Fresh Air and Exhaust Tube Functions

Fresh Air Intake (Larger Tube)

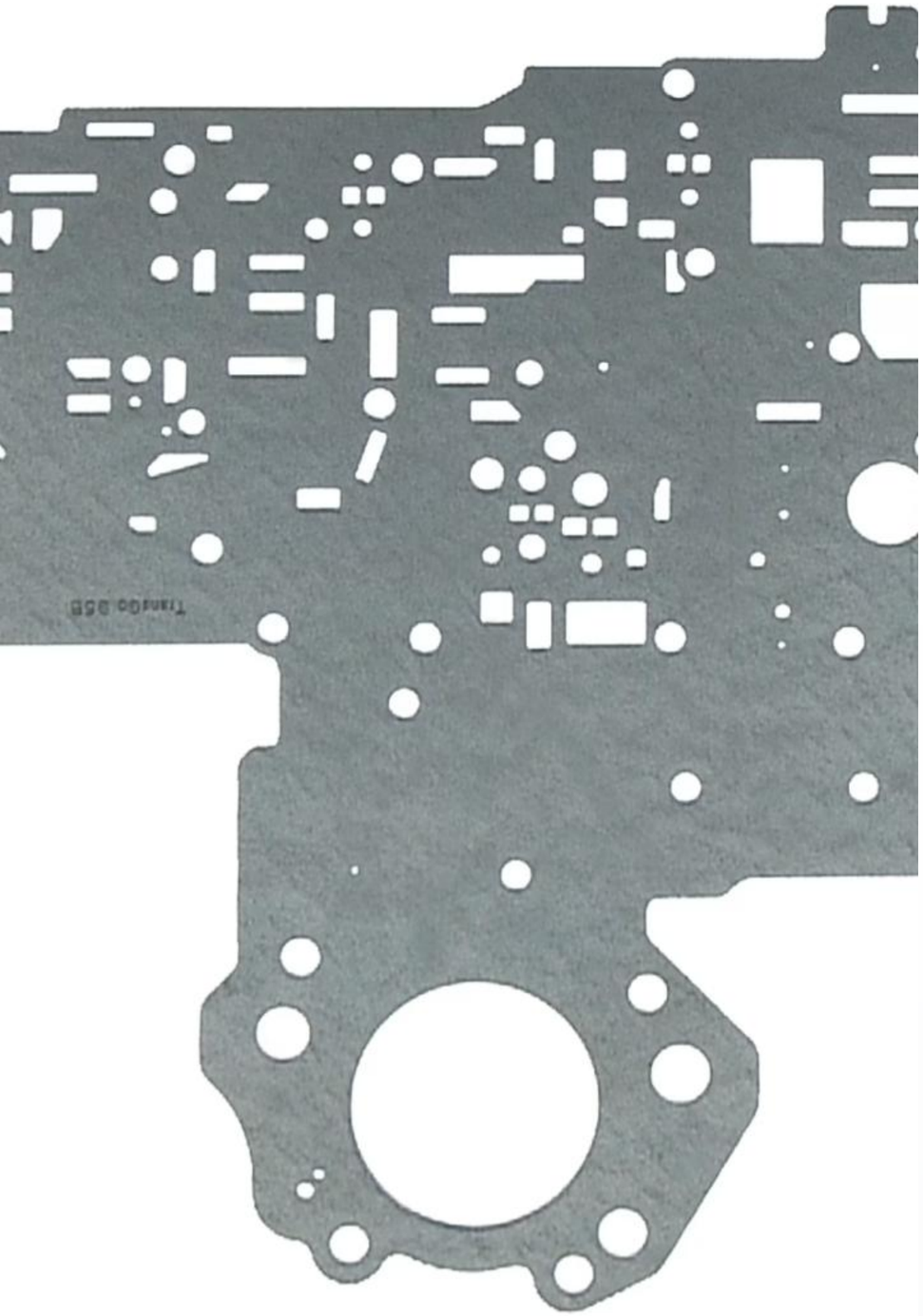
The larger flex tube in a sealed combustion system serves as the fresh air intake, which feeds outside air directly to the burner. This ensures:

- Clean air for combustion
- Consistent oxygen supply
- Independence from indoor air quality
- Improved combustion efficiency

Exhaust Tube (Smaller Tube)

The smaller flex tube functions as the exhaust tube, which is used to dissipate the products of combustion from the boiler tube. This provides:

- Safe removal of combustion gases
- Prevention of carbon monoxide buildup
- Proper venting of water vapor
- Maintenance of indoor air quality



Separator Plate Function

Physical Barrier

Creates separation between intake and exhaust paths

Prevents Recirculation

Stops exhaust gases from being drawn back into fresh air intake

Improves Efficiency

Ensures clean air supply for optimal combustion

Safety Feature

Reduces risk of combustion problems and carbon monoxide production

Vent Housing Angle Importance

Less Than 90° Requirement

The vent housing must not follow the contour of the van; it must be less than 90° to the ground

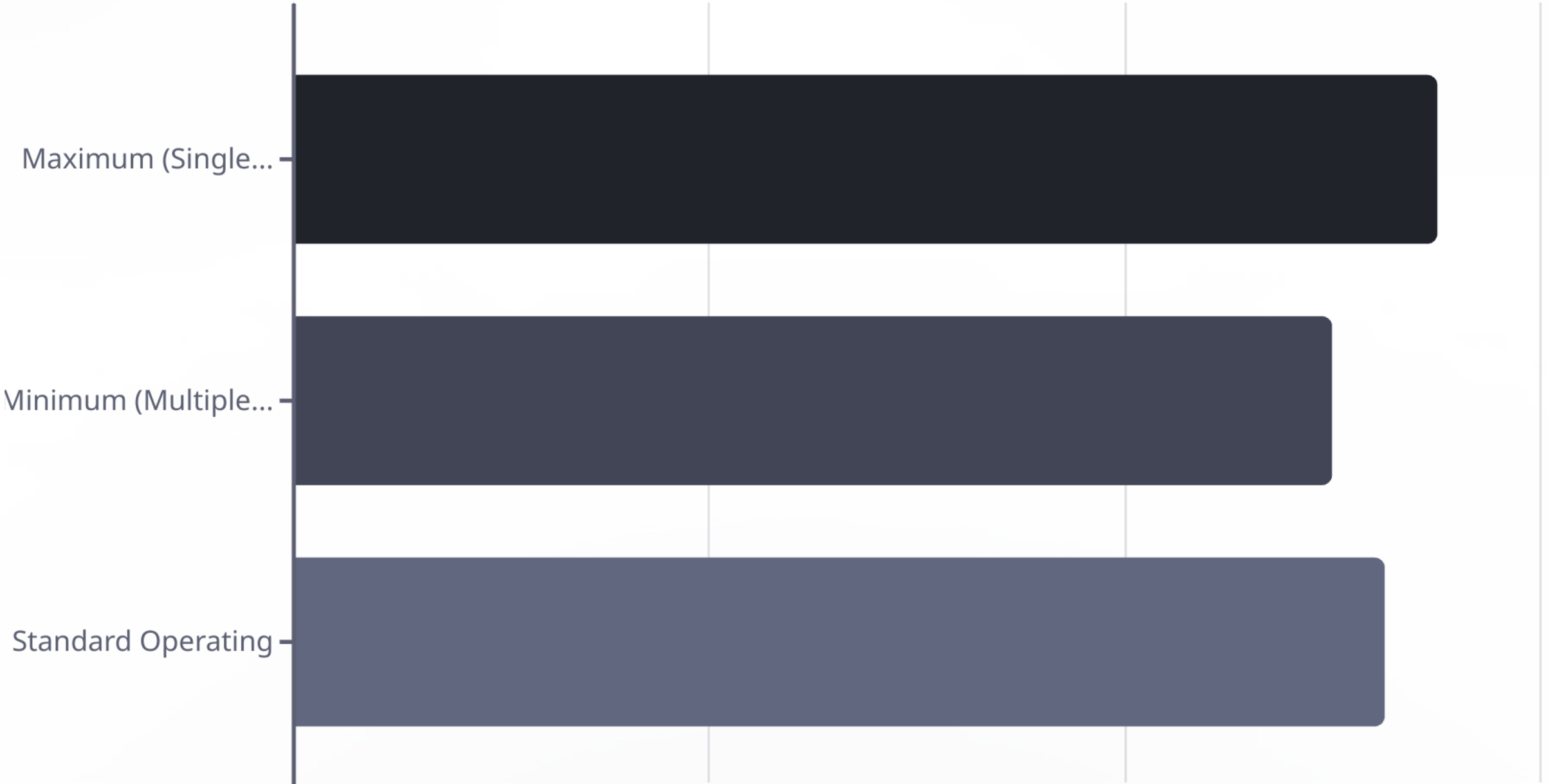
Condensation Management

This angling allows the condensation to flow out of the housing rather than collecting inside

Preventing Damage

Proper drainage prevents water accumulation that could damage components or reduce efficiency

Pressure Testing Requirements



Leak Testing Procedure

Prepare Solution

Use an approved leak detection solution (typically a detergent and water mixture)

Apply to Joints

Apply solution to all gas connections and joints

Check for Bubbles

Observe for bubble formation which indicates a leak

Test All Connections

Check from the gas inlet to the orifice spud

Safety Shut-Off System Testing

1 Follow Instructions

Test the liquefied petroleum gas safety shut-off system in accordance with the manufacturer's instructions

Flame Failure Response

Verify that gas flow stops when flame is extinguished

3 Thermocouple Function

Ensure thermocouple properly detects flame presence

Reset Capability

Confirm system can be properly reset after activation

Flexible Connector Installation

Avoid Kinking

When installing the refrigerator in the selected location, make sure that the flexible connector does not kink

Proper Routing

Route the connector to avoid strain or contact with sharp edges

Accessibility

Position to allow for refrigerator removal without damaging the connector

Common Flue Restrictions

Wall Proximity

Placing the refrigerator too close to the wall

Covering Openings

Placing objects over the opening

Internal Obstructions

Having some obstruction fall into the flue

Dust Accumulation

Buildup of dust and debris over time

Importance of Clean Flues

Operational Efficiency

Keep the flue clean to ensure proper functioning of the refrigerator

Heat Transfer

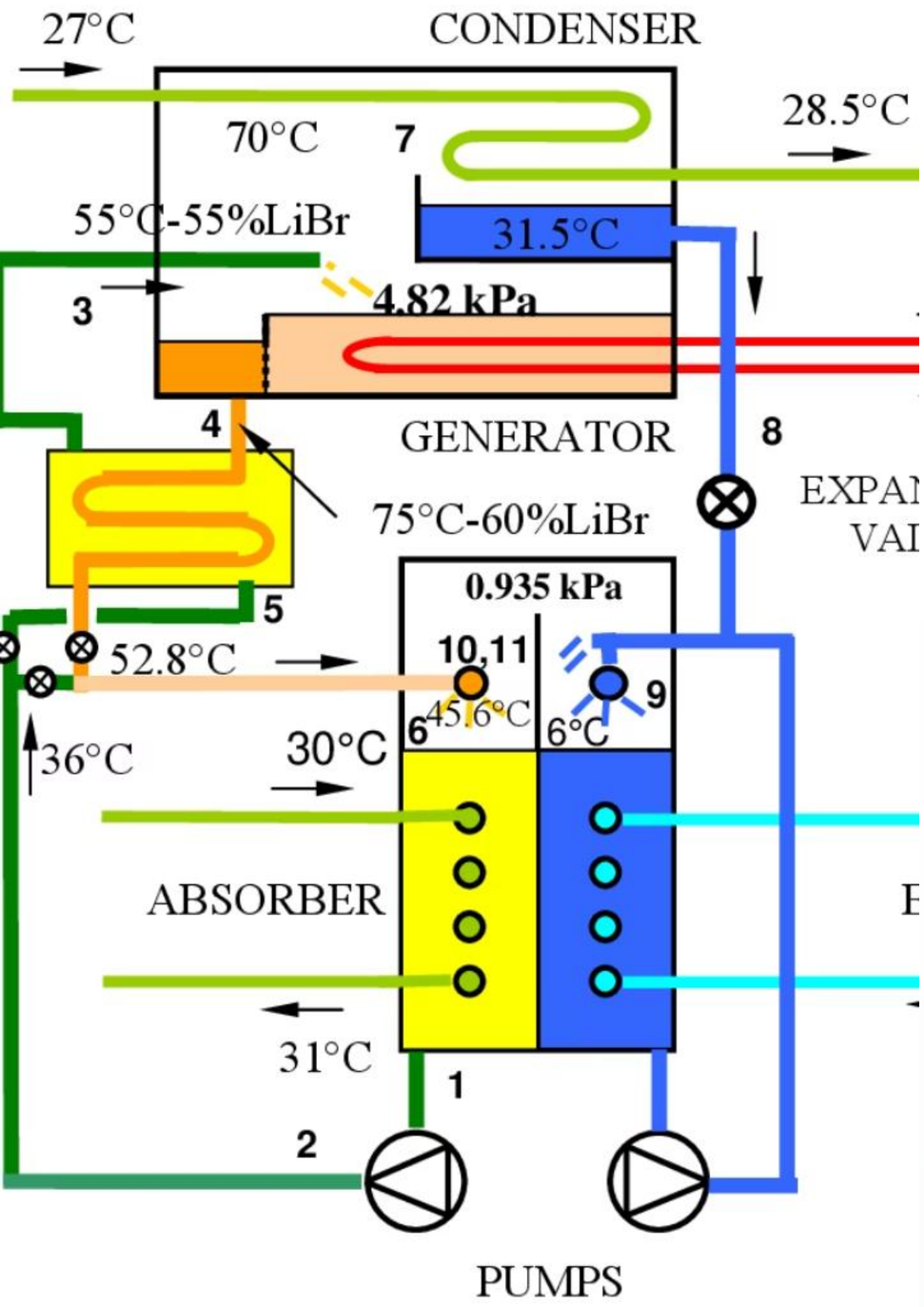
Clean flues allow proper heat dissipation from the generating unit

Safety Consideration

Blocked flues can lead to improper combustion and potential hazards

Regular Maintenance

Include flue cleaning in routine maintenance procedures



Unique Characteristics of Absorption Refrigerators

Noiseless Operation

Unlike compressor refrigerators, absorption refrigerators operate silently

Visual Verification

Customers cannot tell if the unit is working by sound and must rely on cooling performance

Heat-Driven Process

Uses heat (from gas flame) rather than mechanical compression to drive the cooling cycle

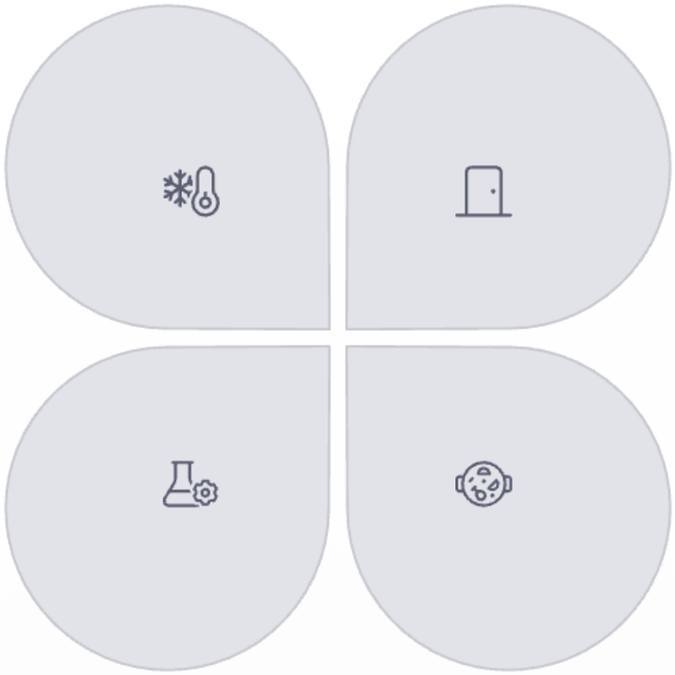
Defrosting Interval Factors

Climate

Ambient temperature and humidity affect frost formation rate

Usage Patterns

Frequency of door opening increases moisture entry



Temperature Settings

Lower temperature settings may increase frost formation

Food Storage

Moisture content of stored items affects frost buildup

Automatic vs. Manual Defrost Systems

Automatic Defrost

- Found in most newer models
- Periodically runs through defrost cycle as needed
- Controlled by the refrigerator's control system
- Requires no user intervention
- May slightly increase energy consumption

Manual Defrost

- Common in older or simpler models
- Requires user to initiate defrost process
- Follows specific procedure outlined by manufacturer
- Typically more energy efficient
- Requires periodic maintenance by user

Freezer Defrosting Frequency

2

Months

Typical interval between freezer defrosting

1/4

Inch

Maximum recommended frost thickness before defrosting

2-3

Hours

Average time needed for complete manual defrost

The freezer needs defrosting less frequently than the main refrigerator compartment, typically every two months or so. However, this can vary based on usage patterns, climate conditions, and the specific refrigerator model.

Drip Pan Positioning During Defrost

Rotate Pan

Turn the drip pan around so that the drain hole is towards the front

Place Container

Position a suitable container under the drain hole to catch the runoff of melting ice

Monitor Collection

Check container periodically to prevent overflow

Return to Normal

After defrosting is complete, return the drip tray to its normal position

Using a Plastic Scraper Properly

Gentle Technique

Use the plastic scraper to remove ice as it melts, being careful not to damage the interior surfaces

Avoid Metal Tools

Never use metal tools or sharp objects that could puncture refrigerant lines

Allow Melting

Be patient and allow ice to soften before attempting removal

Scraping Direction

Scrape in the direction of the drain to facilitate water flow

Removing Components During Defrost

Racks and Shelves

Remove all shelving to allow better access to frosted surfaces

Drawers

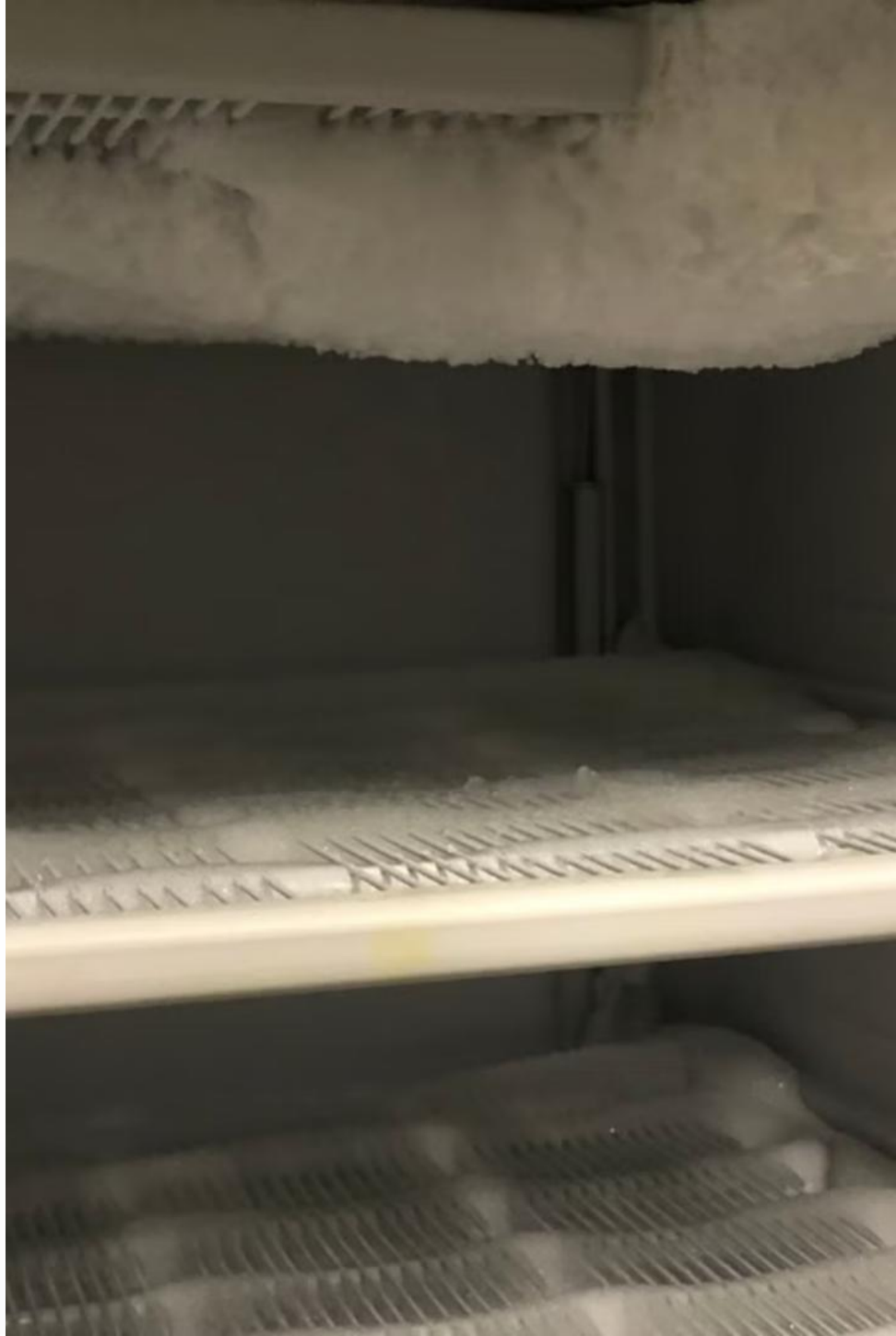
Take out all drawers to prevent water damage and allow thorough defrosting

Batteries

Remove batteries for lights to prevent potential damage from moisture

Food Items

Remove and properly store all food during the defrosting process



Importance of Leaving Doors Open

Air Circulation

Allows warm air to enter and accelerate the melting process

Moisture Escape

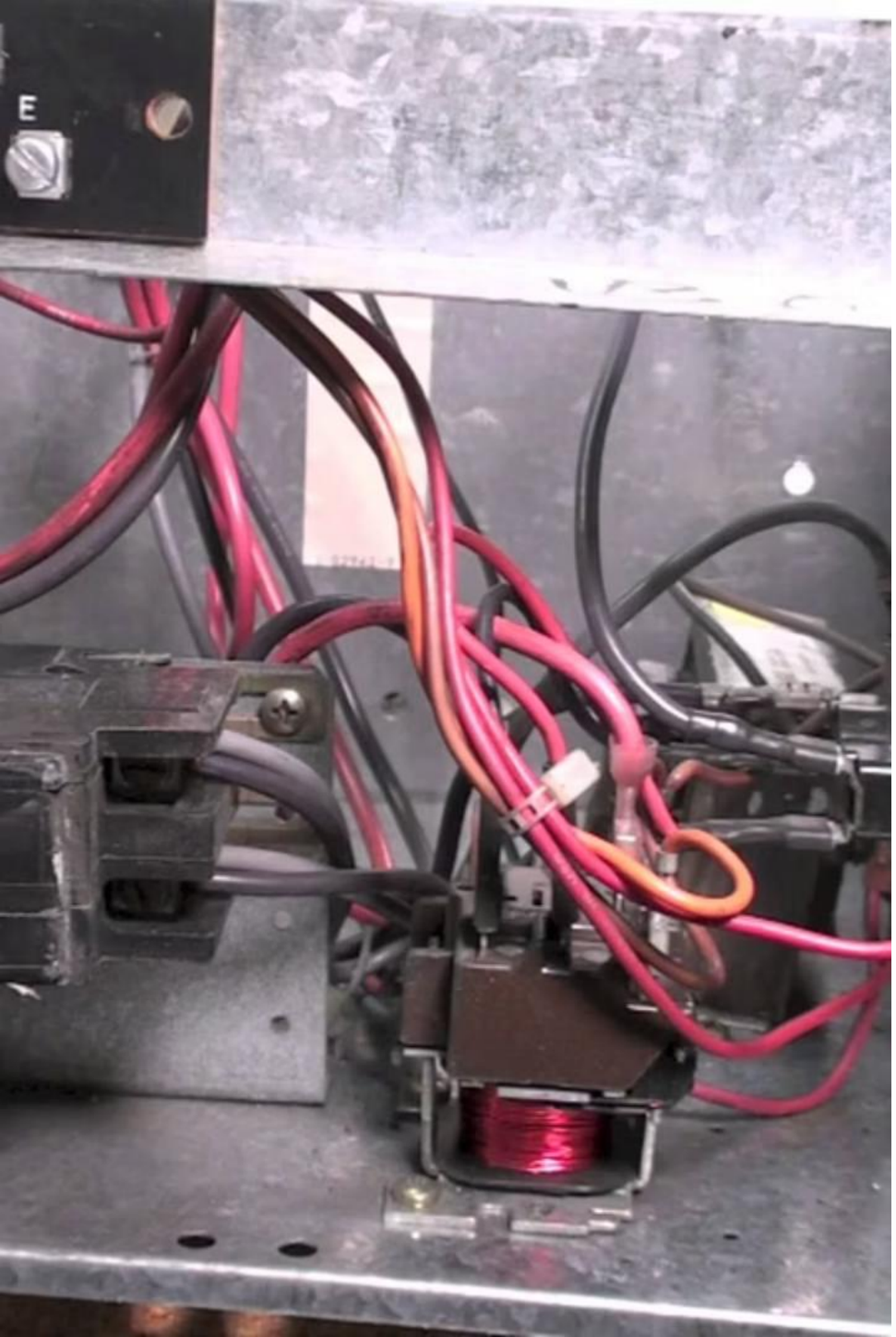
Permits water vapor to exit rather than refreezing inside

Mold Prevention

Prevents moisture accumulation that could lead to mold growth

Complete Defrosting

Ensures all ice is melted before returning to normal operation



Compliance with Mobile Home Standards

CSA Z240.4.1 Requirement

A refrigerator installed in a mobile home or recreational vehicle must comply with CSA Z240.4.1

Special Considerations

Mobile installations may require additional securing to prevent movement during travel

Ventilation Requirements

Mobile installations often have specific ventilation requirements due to limited space

Keeping Refrigerators Free from Hazards

Combustible Materials

Keep all combustible materials away from the refrigerator

Gasoline

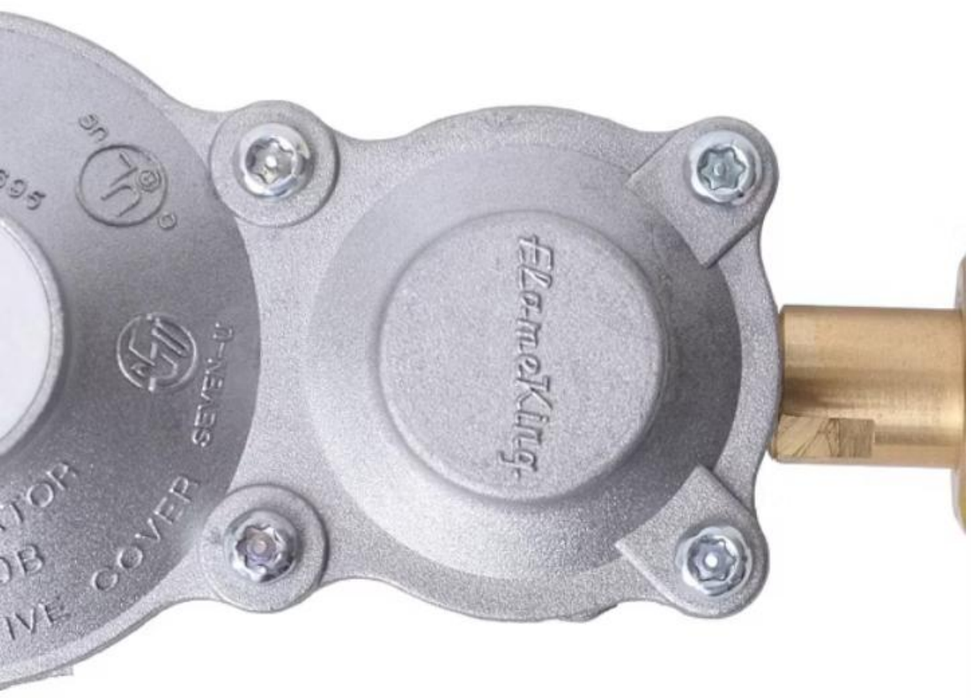
Never store gasoline near the appliance

Flammable Vapors

Avoid flammable vapors in the vicinity

Flammable Liquids

Keep all flammable liquids at a safe distance



Regulator Requirement

Critical Safety Warning

Never connect a propane gas cylinder directly to the refrigerator without a regulator

Pressure Regulation

Regulators reduce the high pressure from the tank to the appropriate operating pressure

Consistent Supply

Ensures steady gas flow for proper refrigerator operation

Damage Prevention

Protects refrigerator components from excessive pressure damage

Installation Summary: Key Points

Proper Location

Follow clearance requirements and ventilation needs

Correct Connections

Ensure proper gas connections with leak testing

3

Adequate Venting

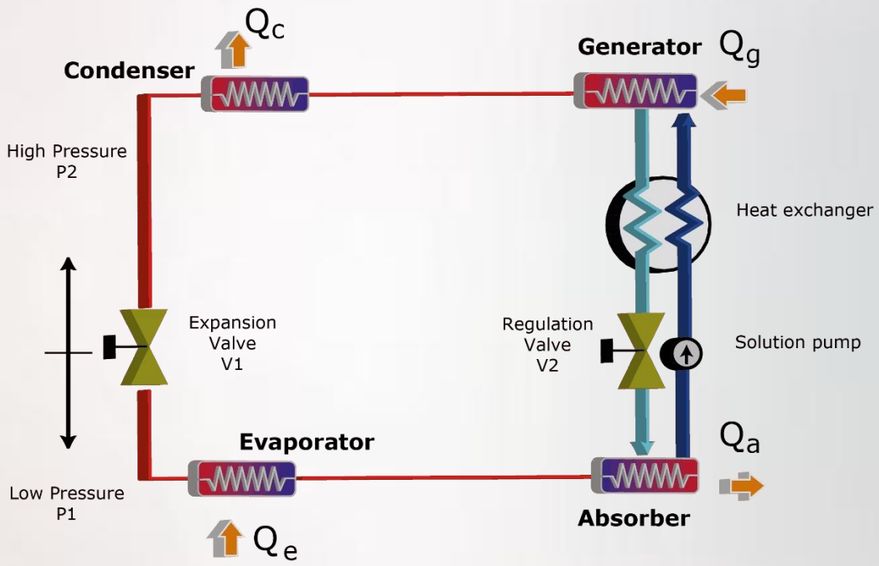
Provide proper ventilation for cooling, combustion, and exhaust

Thorough Testing

Verify all safety systems and proper operation

Customer Education

Instruct on proper operation and maintenance



CSA Unit 16

Chapter 3
Maintenance and Servicing of Gas-Fired Refrigerators

This presentation covers the key factors for ensuring domestic gas-fired refrigerators operate properly, including proper leveling, correct input, and adequate air circulation. We'll explore biannual cleaning and servicing procedures as well as troubleshooting techniques to maintain safe and efficient operation.

Key Factors for Proper Operation

Proper Leveling

The refrigerator must be level to ensure proper operation of the absorption system

Correct Input

Appropriate heat input is essential for the refrigeration cycle

Air Circulation

Proper air circulation is needed to dissipate the heat generated

Learning Objectives

Biannual Cleaning and Servicing

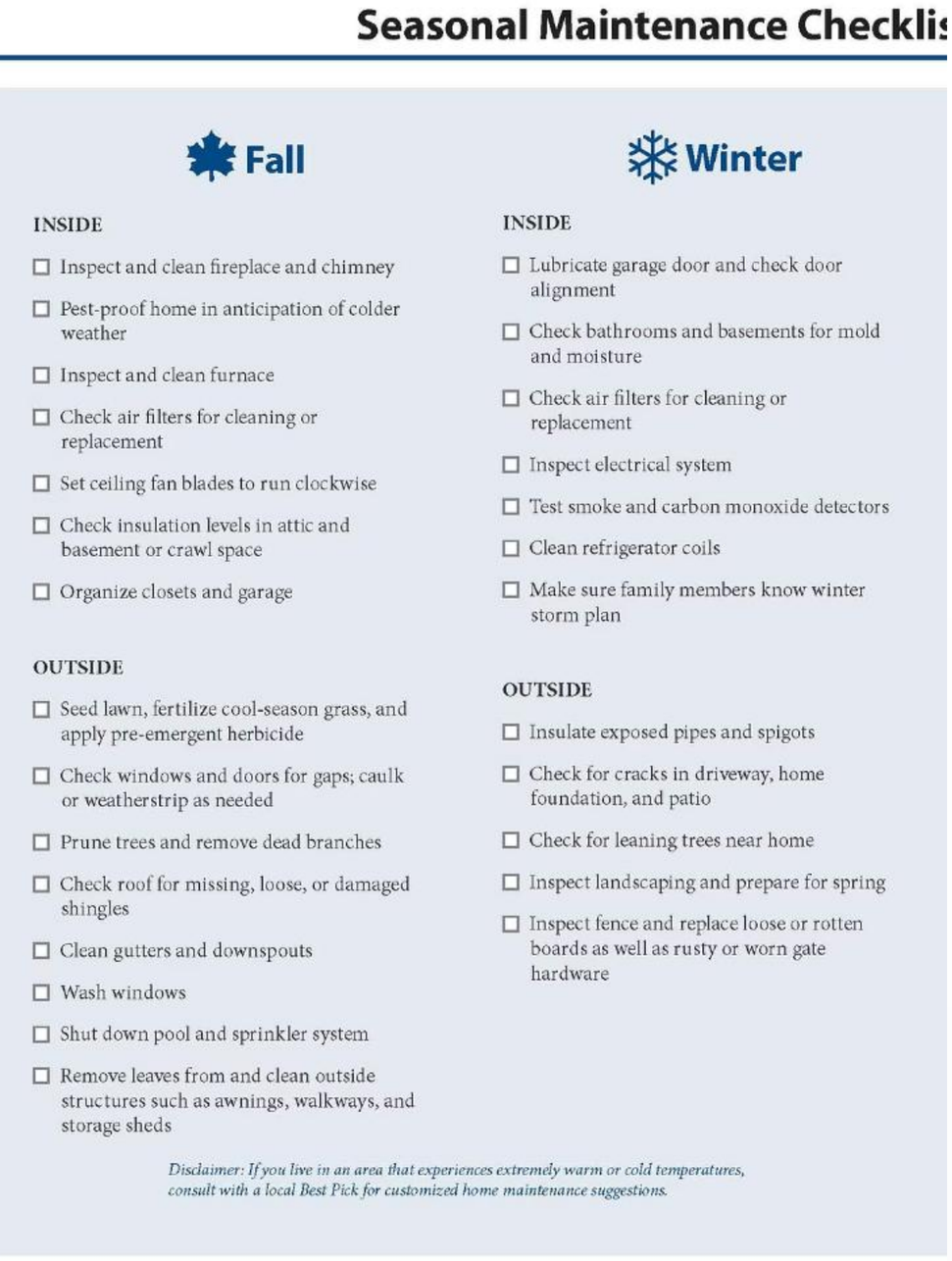
Learn the proper procedures for regular maintenance of gas-fired refrigerators

Troubleshooting Procedures

Understand how to diagnose and resolve common issues with gas-fired absorption refrigerators

Key Terminology

Term	Abbreviation (Symbol)	Definition
Carbon monoxide sensor		Senses carbon monoxide (CO) concentrations in the air.



Seasonal Maintenance Checklis

Fall

INSIDE

- ☐ Inspect and clean fireplace and chimney
- ☐ Pest-proof home in anticipation of colder weather
- ☐ Inspect and clean furnace
- ☐ Check air filters for cleaning or replacement
- ☐ Set ceiling fan blades to run clockwise
- ☐ Check insulation levels in attic and basement or crawl space
- ☐ Organize closets and garage

OUTSIDE

- ☐ Seed lawn, fertilize cool-season grass, and apply pre-emergent herbicide
- ☐ Check windows and doors for gaps; caulk or weatherstrip as needed
- ☐ Prune trees and remove dead branches
- ☐ Check roof for missing, loose, or damaged shingles
- ☐ Clean gutters and downspouts
- ☐ Wash windows
- ☐ Shut down pool and sprinkler system
- ☐ Remove leaves from and clean outside structures such as awnings, walkways, and storage sheds

Winter

INSIDE

- ☐ Lubricate garage door and check door alignment
- ☐ Check bathrooms and basements for mold and moisture
- ☐ Check air filters for cleaning or replacement
- ☐ Inspect electrical system
- ☐ Test smoke and carbon monoxide detectors
- ☐ Clean refrigerator coils
- ☐ Make sure family members know winter storm plan

OUTSIDE

- ☐ Insulate exposed pipes and spigots
- ☐ Check for cracks in driveway, home foundation, and patio
- ☐ Check for leaning trees near home
- ☐ Inspect landscaping and prepare for spring
- ☐ Inspect fence and replace loose or rotten boards as well as rusty or worn gate hardware

Disclaimer: If you live in an area that experiences extremely warm or cold temperatures, consult with a local Best Pick for customized home maintenance suggestions.

Biannual Servicing Requirements

Timing

Service twice a year, preferably before a season of continued use

After Storage

Especially important if the refrigerator has not been in use for some time

Pressure Check

Ensure that the gas supply pressure is correct during servicing

Condenser Fins and Absorber Maintenance

1

Move Refrigerator

Move the refrigerator away from its permanent location, making sure the flexible connector does not kink

2

Clean Dust Buildup

Clean dust from the absorber and condenser, which can lessen heat transfer and impair performance

3

Remove Dust

Remove the dust from the refrigerator and the enclosure

4

Clean Condenser

Clean the condenser using a paintbrush

ar Cleaning of The Unit Will Improv
Efficiency of The Air Conditioning

Importance of Condenser Fin Cleaning

Why Clean Regularly?

Periodical cleaning of fins on the condenser is a must to ensure good heat removal from these surfaces.

Dust buildup can significantly reduce the efficiency of the refrigerator by preventing proper heat dissipation.

Benefits of Clean Condenser Fins

- Improved cooling efficiency
- Reduced energy consumption
- Extended appliance lifespan
- Prevention of system overheating

Flue System Maintenance

Ensure Proper Refrigeration

A clean flue allows for efficient heat transfer to the generator body

Reduce Gas Consumption

Clean flues improve efficiency and reduce operating costs

Prevent Carbon Monoxide

Prevents incomplete combustion and the generation of dangerous carbon monoxide (CO)

Flue Cleaning Procedure - Part 1

Prepare Work Area

Place papers or cloth under the refrigerator to collect dirt or debris

Cover Burner

Cover the burner with a cloth to protect it during cleaning

Remove Flue Extension

Loosen and remove the flue extension carefully

Learn How to Clean Your Dryer Vent!

Prevent dryer fires and increase efficiency by removing lint buildup. Follow these easy steps to clean your dryer vent. #dryerventcleaning #firesafety

Flue Cleaning Procedure - Part 2

Remove Baffle Assembly

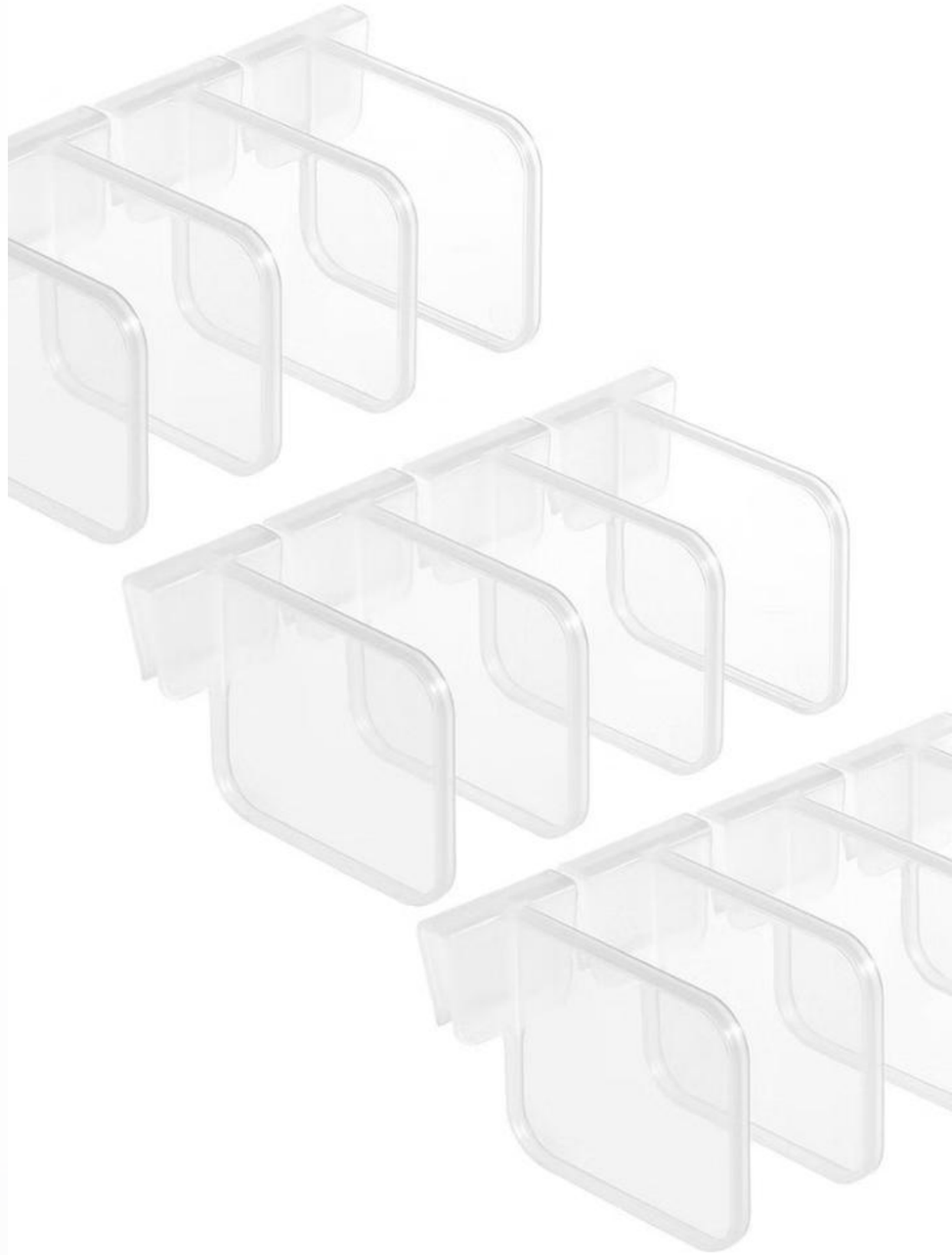
Take out the baffle assembly for cleaning and inspection

Inspect Baffle

Check for burnt dust and light surface corrosion; ensure the tip is intact and not corroded

Check for Soot

Soot must not be present as it indicates incomplete combustion; contact dealer if found



Flue Cleaning Procedure - Part 3

Clean Flame Tube

Run the brush through the flame tube; soot must not appear

Reassemble Baffle

Reassemble the baffle checking its extension, if necessary

Install Flue Extension

Assemble the flue extension, making sure that the wire of the baffle fits into the baffle's slot

Flue Cleaning Procedure - Part 4

Remove Cloth

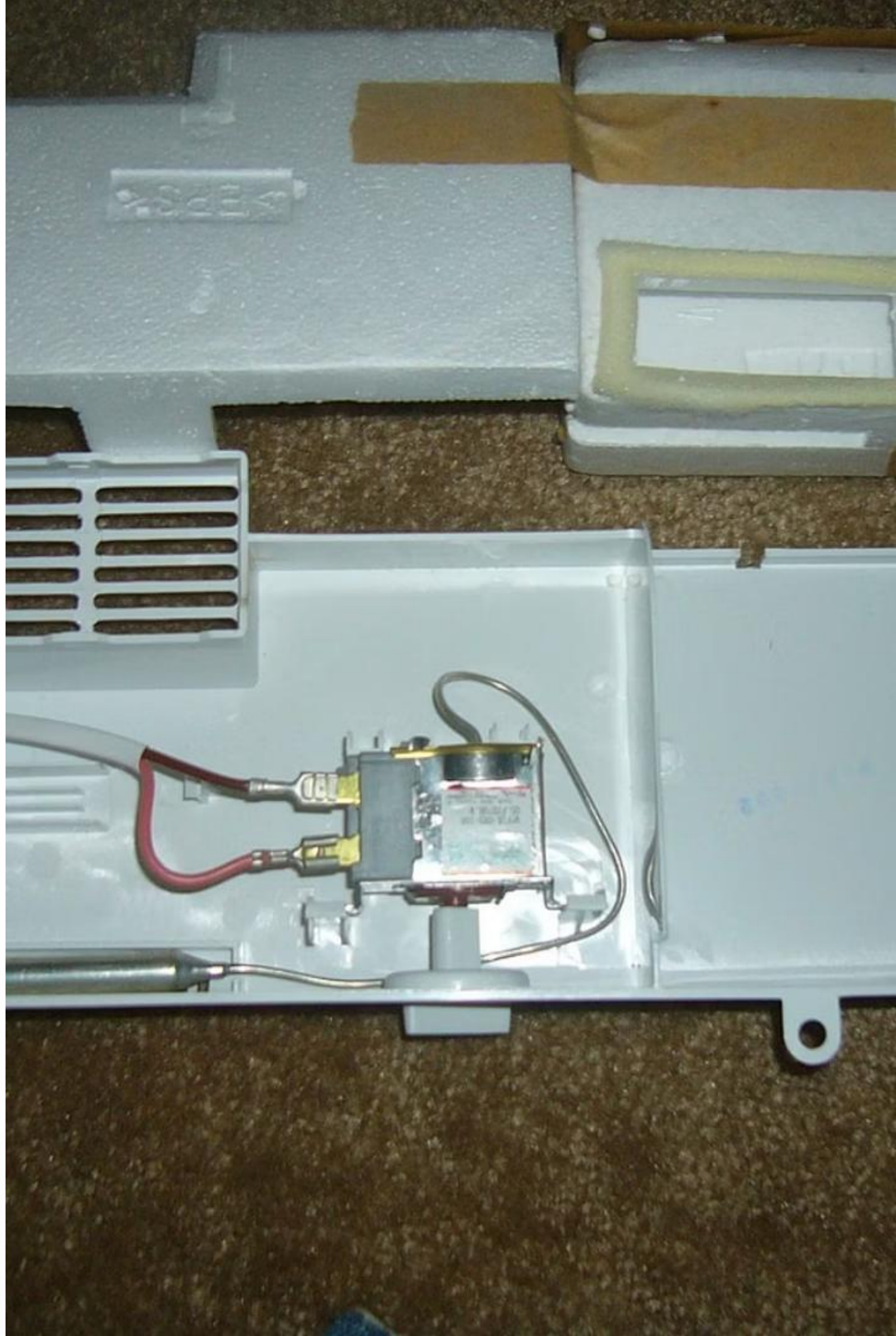
Remove the cloth from the burner

Reinstall Burner Box

Carefully reinstall the burner box in its proper position

Verify Operation

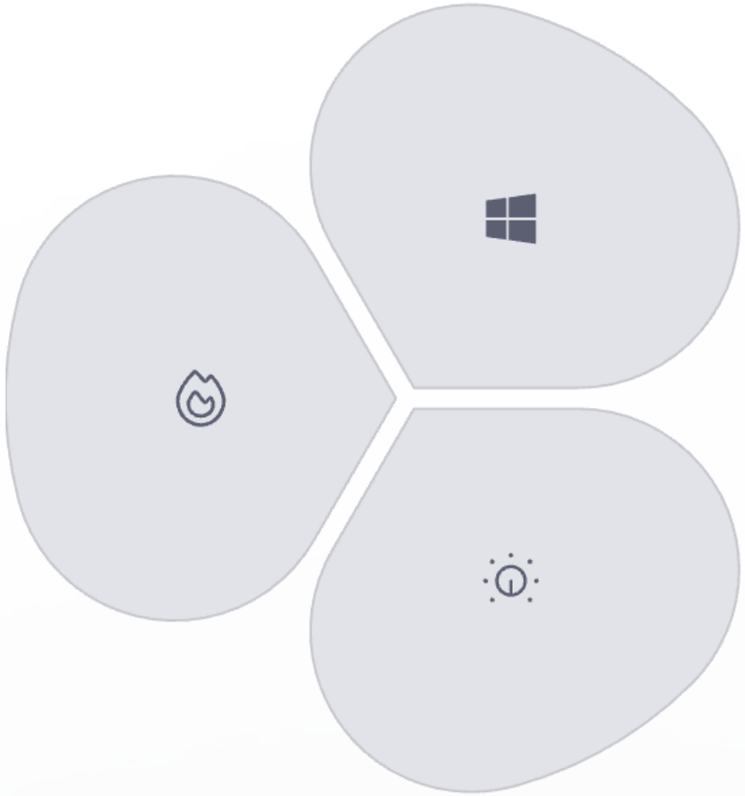
Check the refrigerator operation to ensure proper functioning after cleaning



Three Key Factors in Absorption Refrigerator Servicing

Heat Input

Proper heat input is essential for the refrigeration cycle to function correctly



Air Circulation

Adequate airflow is needed to dissipate heat from the system

Levelling

The system must be level to allow proper flow of liquids in the absorption system

Heat Input Considerations

Manufacturer Design

The manufacturer designs the refrigerator so that the maximum input setting is high enough for the unit to respond quickly to added loads but not so high that the generator is scorched or blistered.

The minimum input setting is low enough to prevent over-cooling but not so low as to allow the flame to be blown out by drafts.

Heat Input Checks

1. Check gas pressure using a manometer at the pressure tap on the thermostatic valve
2. Clean or replace partially blocked orifices
3. Clean or replace the filter in the gas control inlet side
4. Clean generator and flue passages if flame is impinging on surfaces or burning yellow

Proper Air Circulation Requirements

Unrestricted Airflow

Air flow to and from the unit must not be restricted for proper operation

Proper Spacing

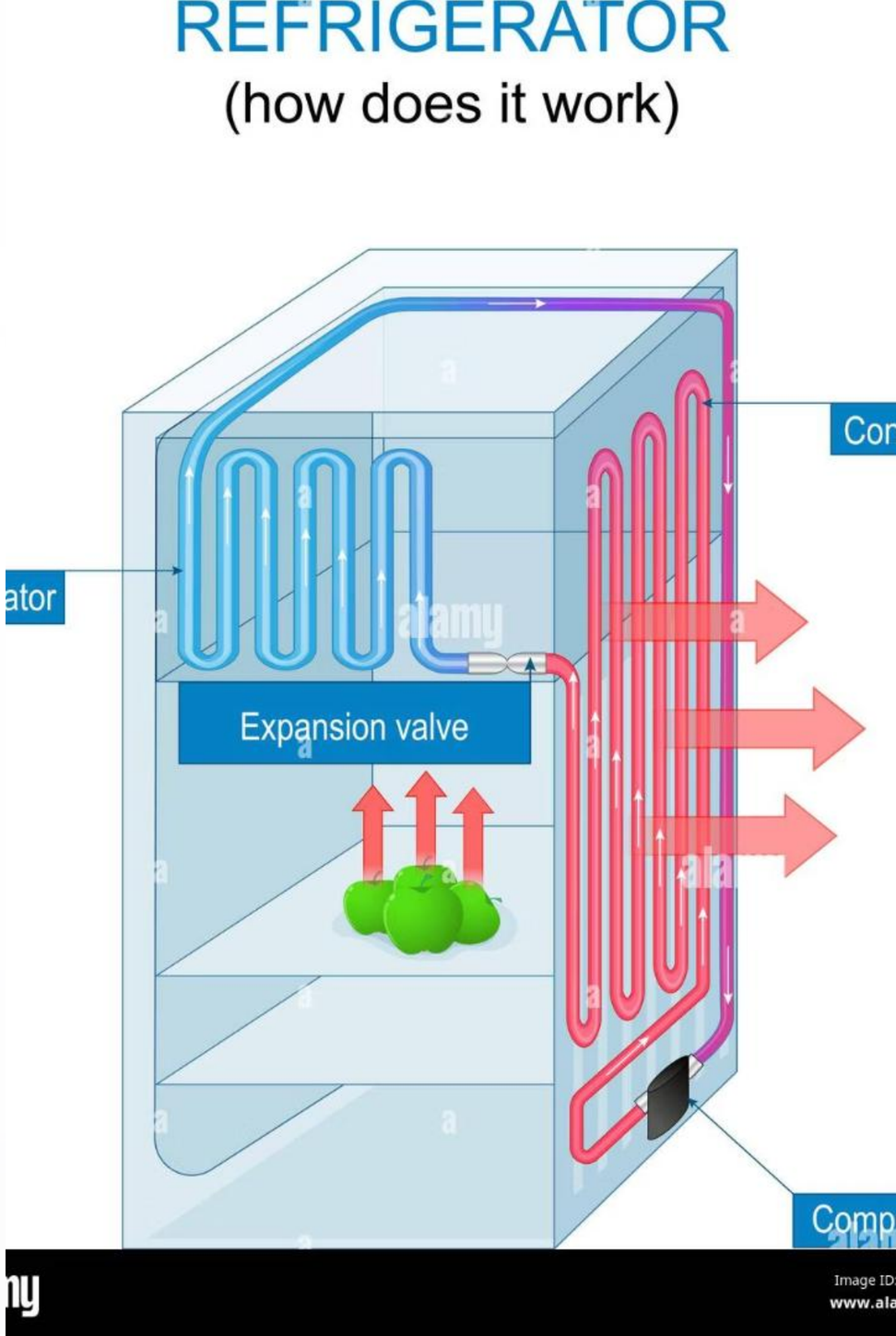
Ensure that the back of the refrigerator is the correct distance from the wall

Clear Pathways

Check that foreign objects have not fallen into the space behind the refrigerator

Clean Cooling Fins

The cooling fins of both the condenser and the absorber must be free of dirt and lint, which would hamper the flow of air and the release of heat to the atmosphere



Proper Levelling Importance

System Design

Keep the system level during installation and maintenance, allowing liquids to flow in the proper direction so that heat is absorbed and released according to the system's design.

It is important that the evaporator is level so that the liquid ammonia is spread out over a large area. This allows the heat to be drawn efficiently from the refrigerator cabinet.

Maximum Off-Level Limits

- 3 degrees from side-to-side
- 6 degrees from front-to-back

Exceeding the maximum off-level limits can permanently damage the cooling unit. In mobile gas-fired refrigerators, the cooling unit or its performance are not affected when the vehicle is in motion.

Restarting Temporarily Unused Units

1

Shutdown Method

Shut the unit off for several hours, allowing all the ammonia vapour to condense and flow back to the generator and to fill the liquid traps

2

Tilting Method

After about 10 minutes of operation, tilt the unit to the left for 30 seconds, then to the right for 30 seconds

3-4

Repeat Process

Repeat tilting step three or four times, then put the refrigerator in the upright, level position

If the unit is not defective, it should begin freezing after these procedures.

Testing Components Overview

Service Manual

Always refer to the manufacturer's service manual for specific testing instructions

Proper Tools

Use appropriate testing equipment for each component

Documentation

Record all test results for future reference

Safety First

Follow all safety procedures when testing gas appliance components

Carbon Monoxide Sensor Testing

Regular Testing

For units supplied with a CO sensor, manufacturers recommend testing the alarm operation at least once per week during use or if the appliance has been turned off for a period of time

Test Button

Push and hold the test button down until a "beep" is heard, then release button

Circuit Test

Unit will test measurement circuit for correct operation

Confirmation

At the end of the test, the unit will sound a three-second test confirmation beep and resume normal operation

Note: The test will shut down the gas supply to the appliance so it will need to be re-lit to resume operation.

Flame-Failure Device Testing

Set Thermostat

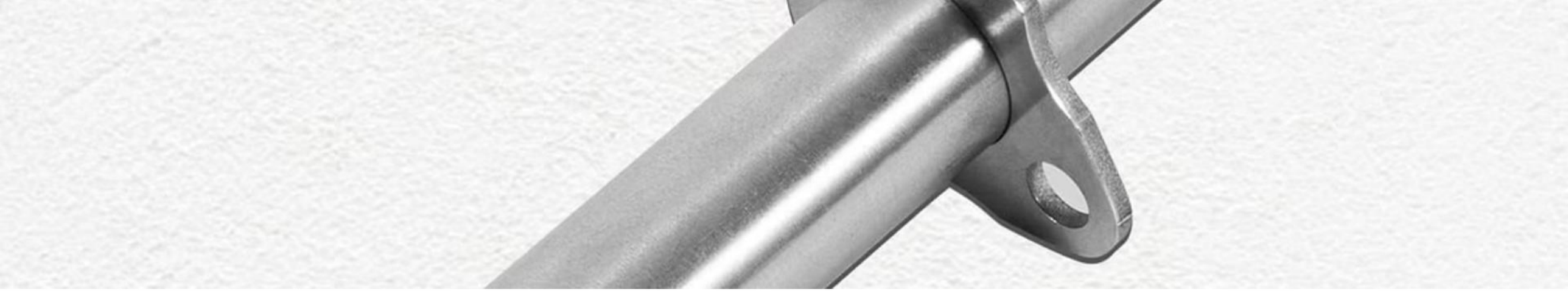
With the refrigerator running, set the thermostat to the coldest setting

Test Valve

Close and then immediately open the selector valve. The flame will go out, but the gas supply will continue to flow

Listen for Click

Listen carefully. In about 30 to 40 seconds, you will hear a slight but very distinct "click" to signify that the valve has closed



Replacing the Orifice (Injector) Housing

Disassemble

Disassembling the nipple holder with two open-end spanners can help take off the orifice (injector)

Inspect and Clean

Take off the injector piece and check whether it is obstructed. Clean with alcohol and compressed air

Clear Gas Tube

Before reassembling, tap gently a few times on the gas tube leading to the burner to loosen any lint collected in the tube

Reassemble

Reassemble and tighten carefully

Replacing a Gas-Only Burner

1

Remove Cover

Remove the cover by removing the screws

2

Unscrew Jet

Unscrew the burner jet

3

Remove Burner

Remove the burner by removing the mounting screw

4

Insert Replacement

Insert replacement burner that is the same make and model

5

Reassemble

Reassemble the mounting screw and cover

Replacing a Gas-Electric Burner - Part 1

Remove Covers

Remove the covers by removing the screws

Disconnect Heater Cords

Disconnect the heater cords at the terminal blocks (note the location for later reassembly)

Remove Capillary Tube

To avoid damaging the capillary tube, remove it carefully from the evaporator

Replacing a Gas-Electric Burner - Part 2

Remove Screws

Remove the screws securing the burner assembly

Release Burner Housing

Release the burner housing from the flue by turning the lever outwards and to the right

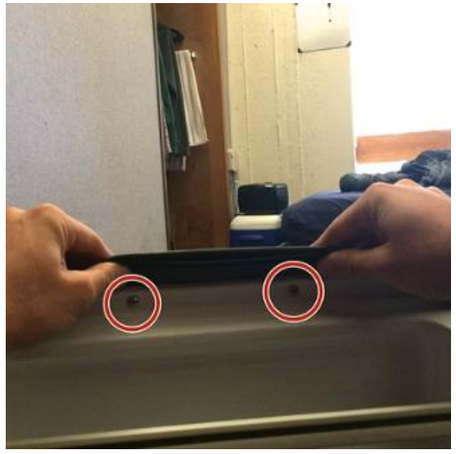
Remove Equipment

Pull the equipment out from the cabinet

Replace Burner

Replace the burner with the same make and model

Additional Components for Servicing



These components also affect the overall performance of a refrigerator and should be tested and serviced during a call. Always refer to the manufacturer's service manual for cleaning, testing, and servicing instructions.

Components Requiring Regular Service

Cabinet and Absorber Fan Motors

Ensure proper operation and clean as needed

Cabinet Lights and Door Switches

Test functionality and replace if necessary

Heaters and Defrost Systems

Check heaters, defrost switch, and safety switch

Door Seal

Inspect for proper sealing and replace if damaged

Refrigeration Unit

Inspect for proper operation and leaks

Troubleshooting Procedure Overview

Clarify Complaint

Ask questions to get as much information as possible from the customer

Interpret Complaint

Use manufacturer's service manuals to understand the issue

Identify Faults

Identify potential faults causing the complaint and test the components believed to be at fault

Checking for Refrigerant Leaks

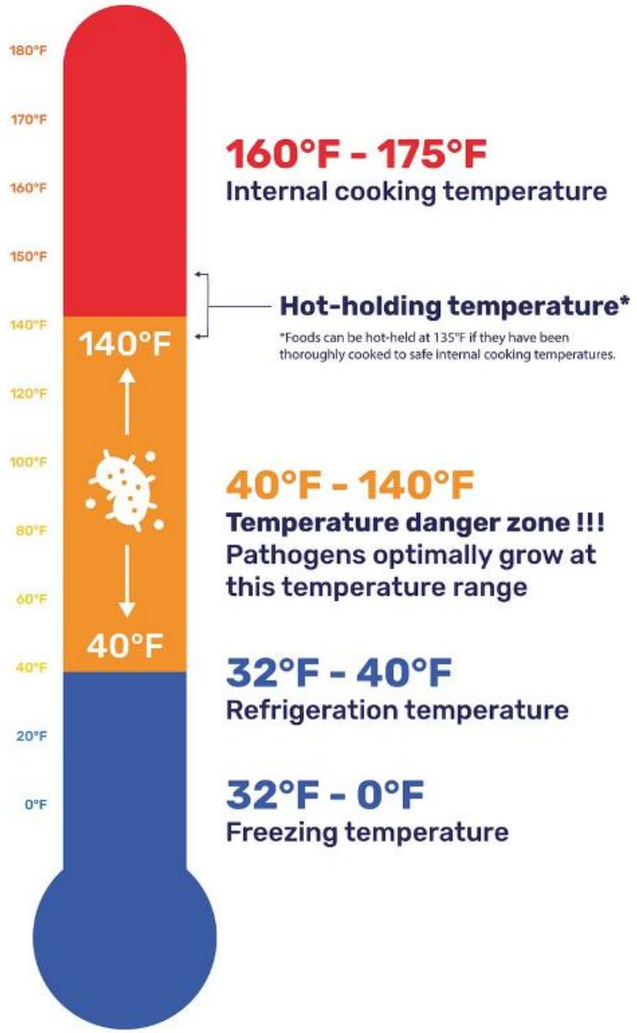
Sodium Chromate Indicator

Check for the presence of sodium chromate, identified by its bright yellow colour:

- This chemical solidifies when exposed to air
- If this shows up on the outside tubes, it is a sign that there is a refrigerant leak

The bright yellow color of sodium chromate is a clear indicator of a leak in the refrigeration system and requires immediate attention.

Freezer temperature chart



Temperature Diagnostics – Part 1

If	Then
The cooling unit is functioning properly.	There will be even heat on both the boiler section and the middle of the absorber coils.
The boiler section is hot, and the absorber section is warm.	This indicates that the evaporator unit is blocked.

Temperature Diagnostics - Part 2

If	Then
The boiler section is warm, and the absorber is hot.	The hydrogen circuit has lost its charge of hydrogen. The boiled ammonia is circulating through the cooling unit because there is no hydrogen present to cause it to evaporate.
The inside of the fridge is warm, but there is frost on the condenser fins.	This indicates an internal leak in the evaporator.

Gradual Cooling Efficiency Decrease

Not Always a Failure

A gradual decrease in cooling efficiency is not a clear indication of cooling system failure.

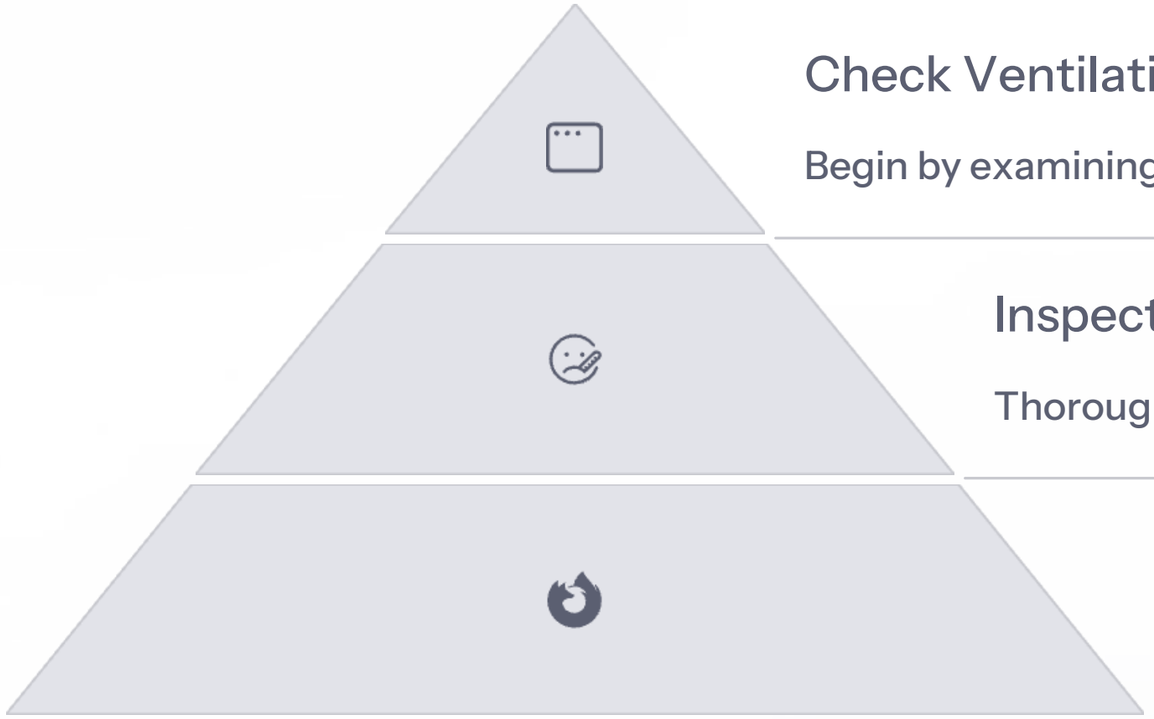
Multiple Factors

Other factors that affect cooling efficiency include ventilation, heat input, off-level operation, lack of service and maintenance, inadequate repairs, and unauthorized field modifications.

Systematic Approach

Step-by-step troubleshooting is the best approach when dealing with a gradual decrease in cooling. It is important to consider that the cooling unit is working, though not efficiently.

Troubleshooting Approach for Cooling Issues



Check Ventilation First

Begin by examining airflow around the unit

Inspect Cooling Unit

Thoroughly examine all cooling components

Verify Heat Sources

Ensure proper heat input to the system

In the majority of reported cases, the problem was related to the installation, which in turn hindered cooling unit ventilation. Additionally, ambient air temperature plays a significant role if the unit was not installed correctly.

Installation and Ventilation Relationship

Installation Impact

Incorrect installation leads to poor ventilation, which relates to poor cooling performance.

Consider the unit's service and maintenance history when checking a cooling unit for poor cooling performance. The service history and the scope of service work performed may lead directly to the cause and resolution of a cooling problem.

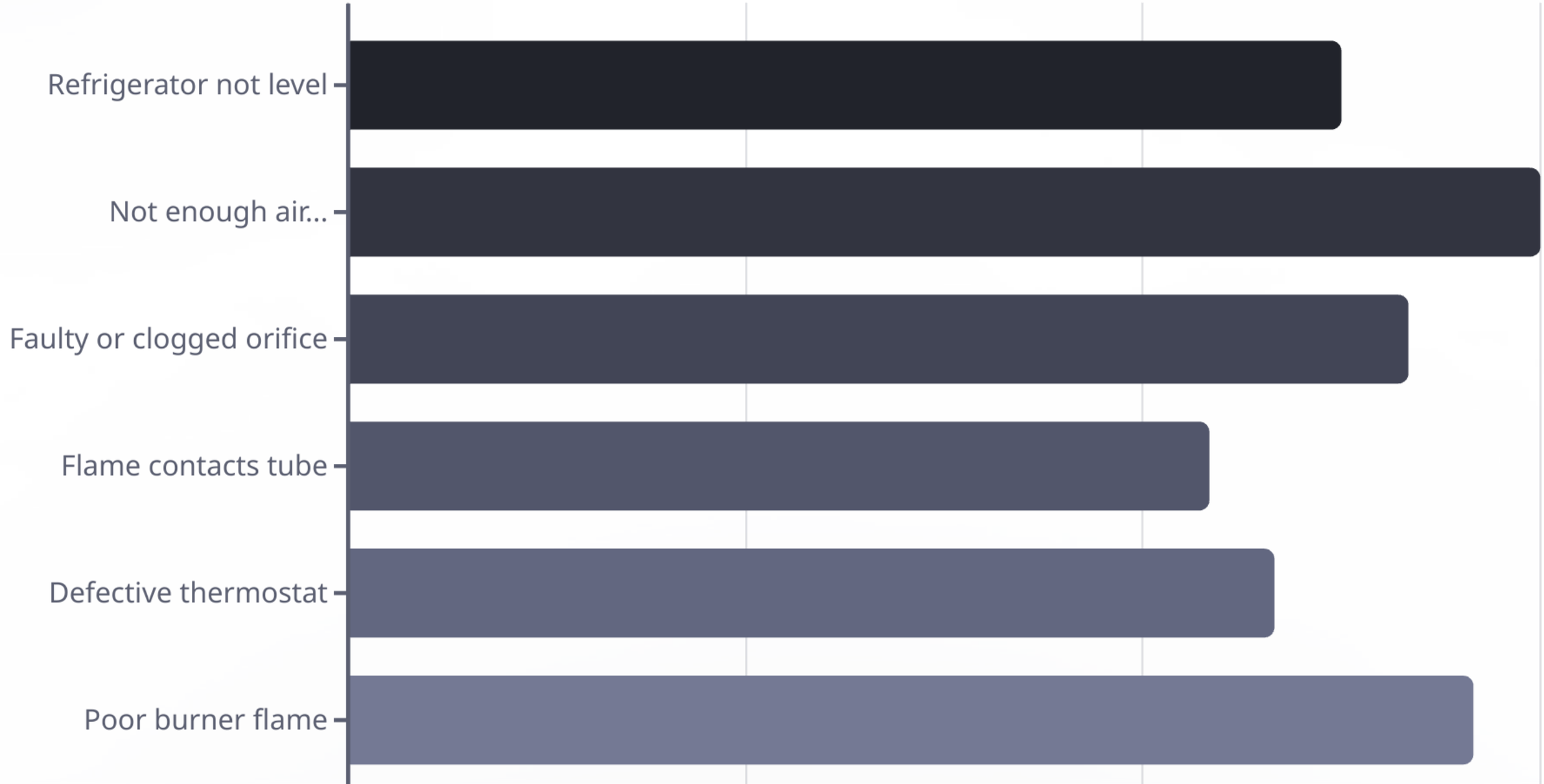
Operating Temperature

The cooling unit must reach normal operating temperatures before troubleshooting can take place. It takes an average of 4 hours for the refrigerant to reach normal operating temperatures.

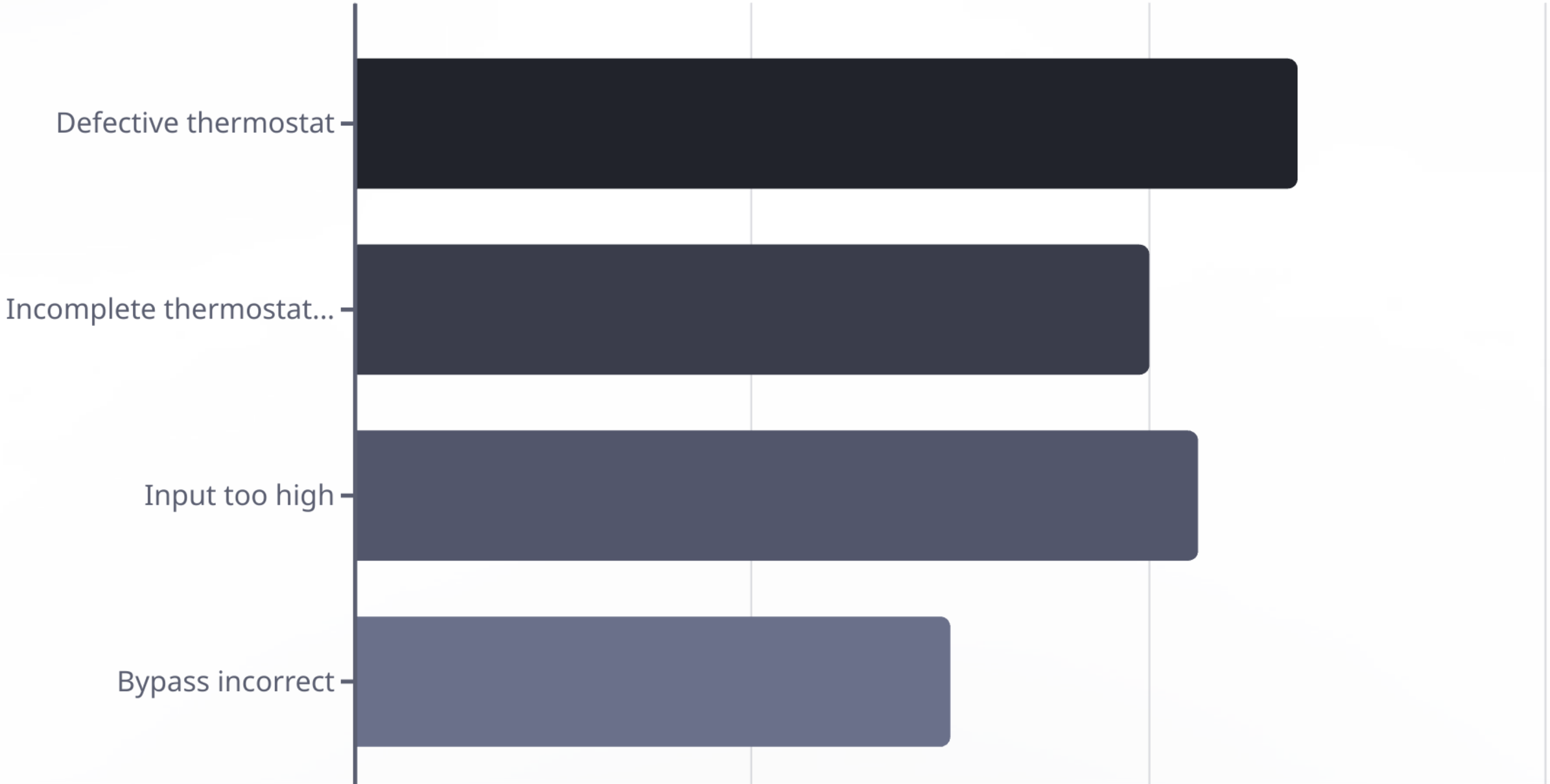
The time frame to reach operating temperatures depends on ambient air temperature.

Troubleshooting Chart - No Refrigeration

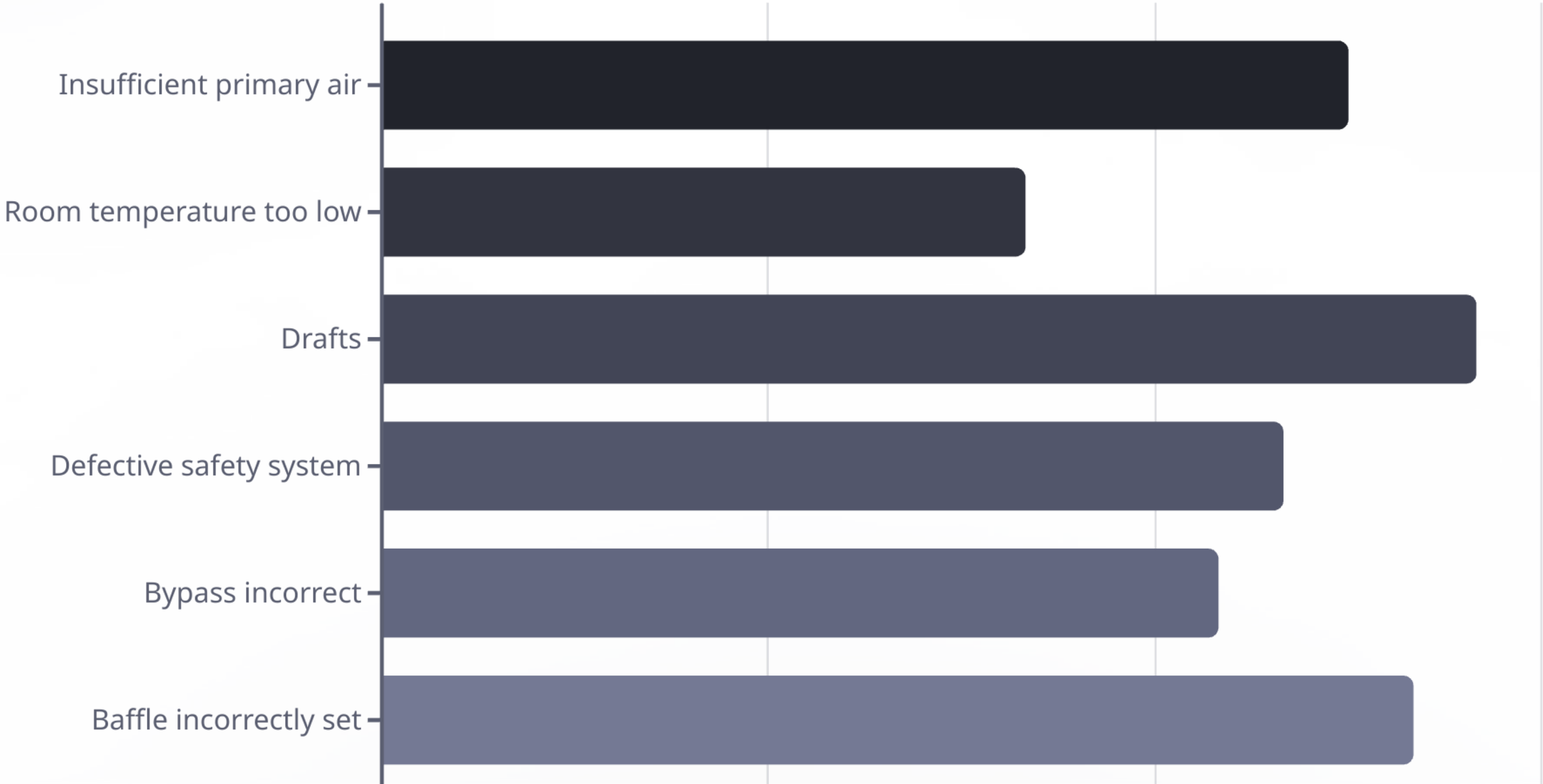
Troubleshooting Chart - Not Cold Enough



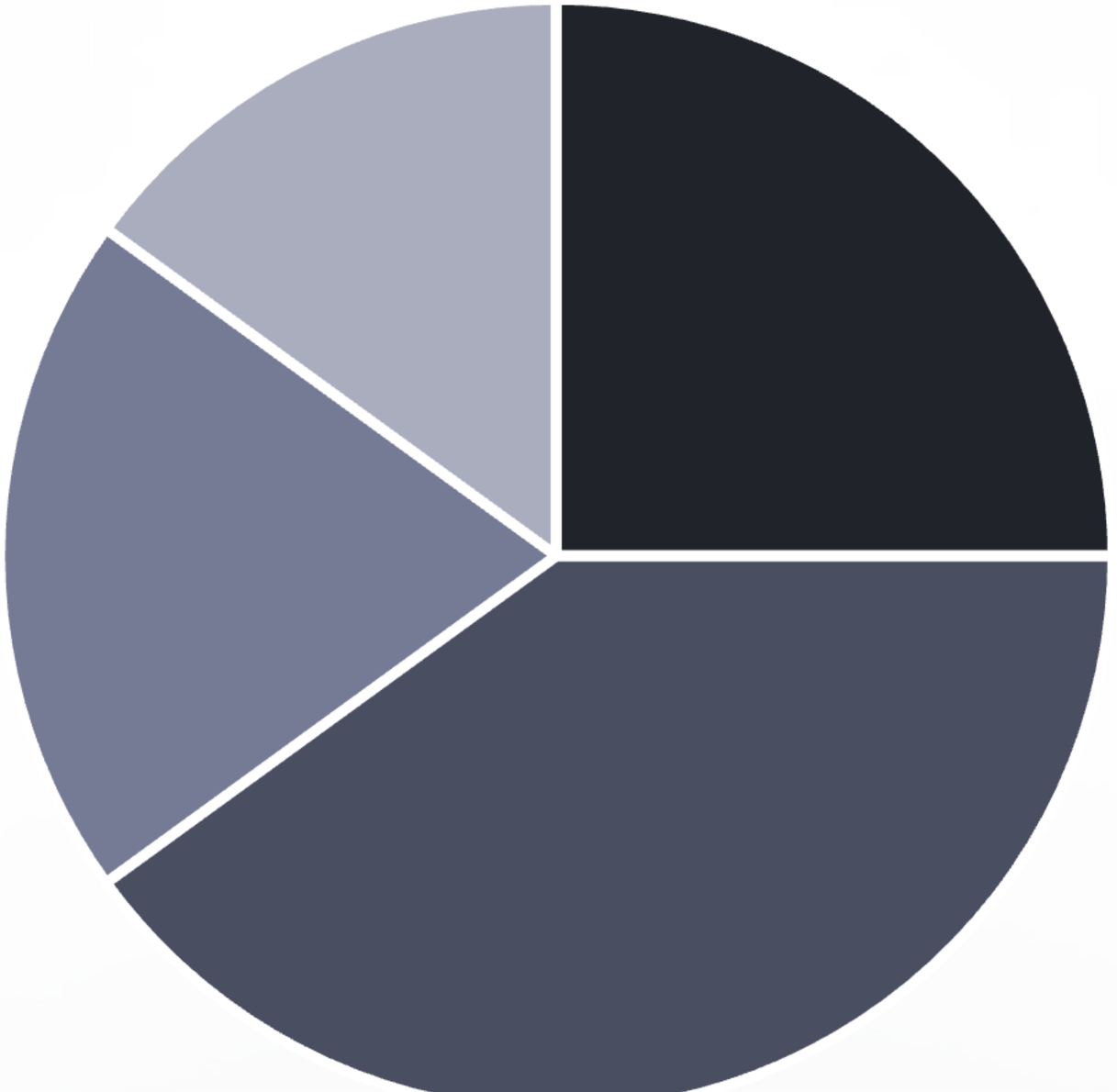
Troubleshooting Chart - Too Cold



Troubleshooting Chart - Burner Flame Issues



Troubleshooting Chart - Odor Issues



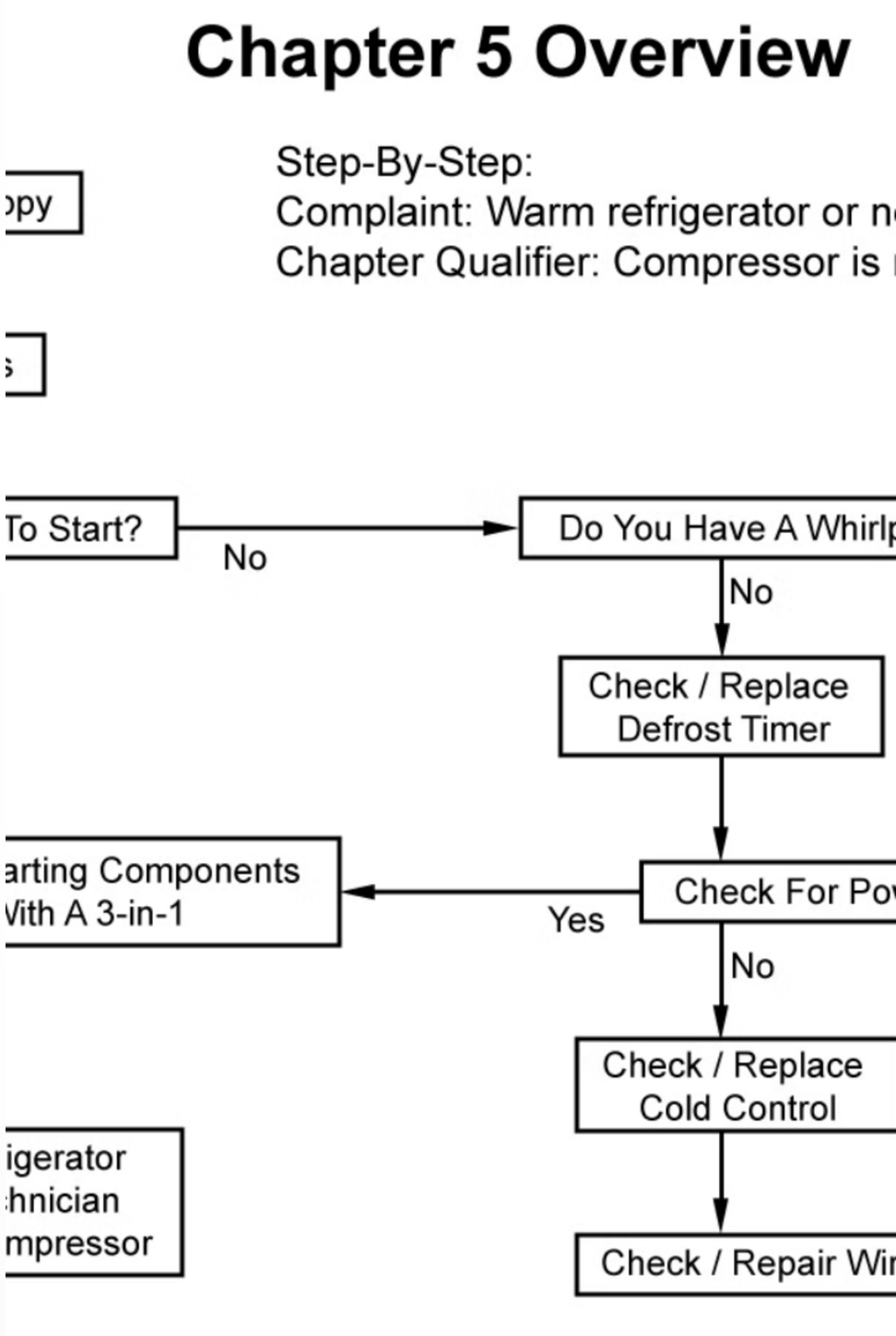
Troubleshooting Chart - Frost Formation

Troubleshooting Chart - Defrosting Problems

Troubleshooting Chart - System Leaks

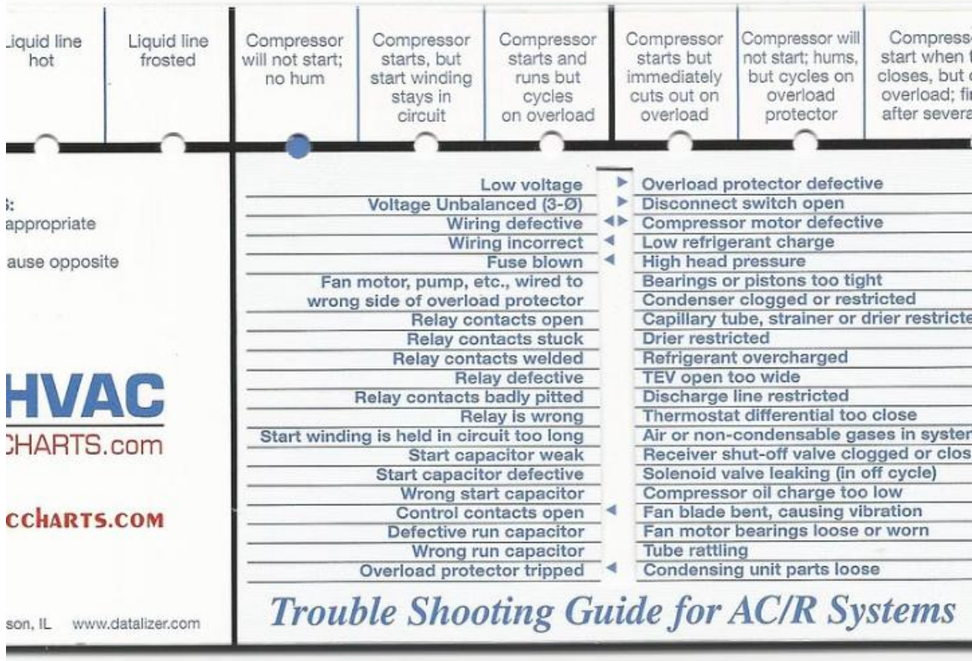
Comprehensive Troubleshooting Matrix

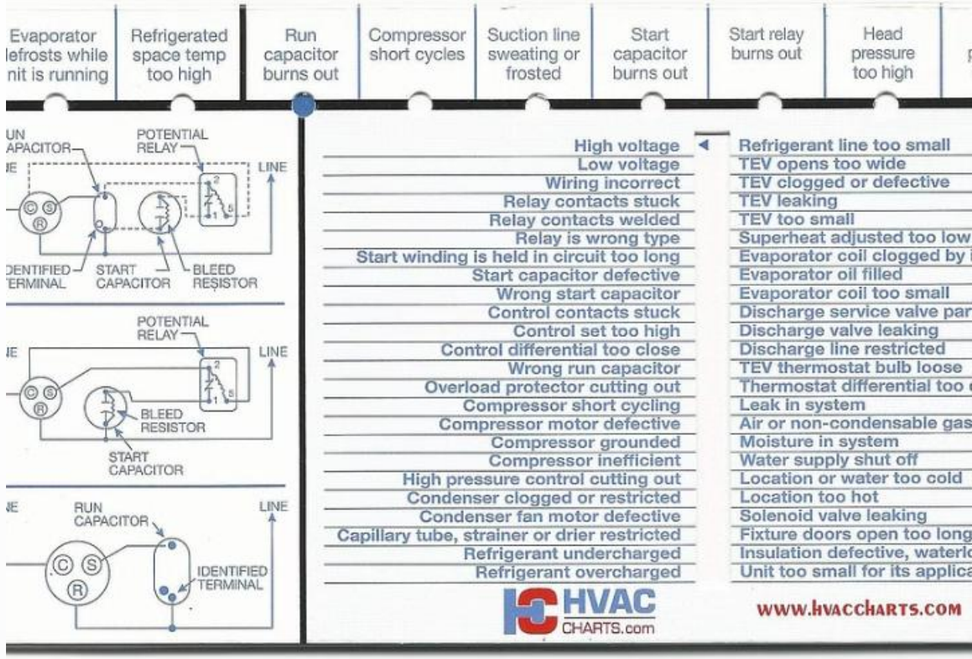
Problem	Gas leak	Not level	Poor air circulation	Faulty orifice	Flame issues
No refrigeration	•	•	•	•	
Not cold enough		•	•	•	•
Too cold					
Flame goes out			•	•	•



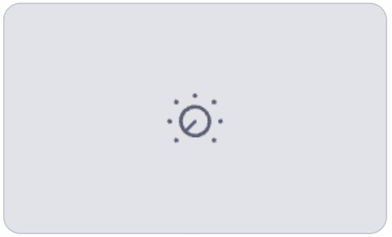
Troubleshooting Matrix Continued

Problem	Flue blocked	Defective thermostat	Poor sealing	System leak
No refrigeration	·			·
Not cold enough	·	·	·	
Too cold		·		
Odors			·	·
Frost forms rapidly			·	



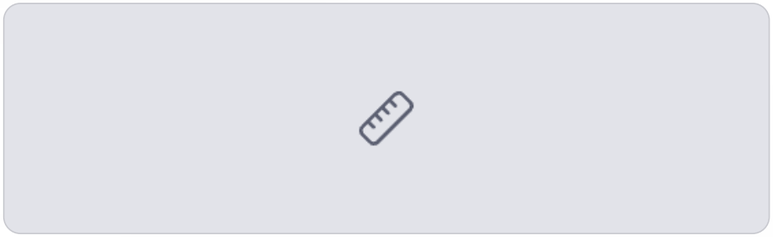


Importance of Proper Leveling



Gravity Flow

The circulation of refrigerant relies on gravity



Maximum Limits

3° side-to-side, 6° front-to-back

Damage Risk

Exceeding limits can permanently damage the unit

The circulation of the refrigerant through the cooling unit is accomplished by gravity flow; therefore, the refrigerator must be operated in the level position. Off-level operation affects the flow of the refrigerant through the cooling system.

Heat Input Balance

Maximum Setting

High enough for quick response to loads

Generator Protection

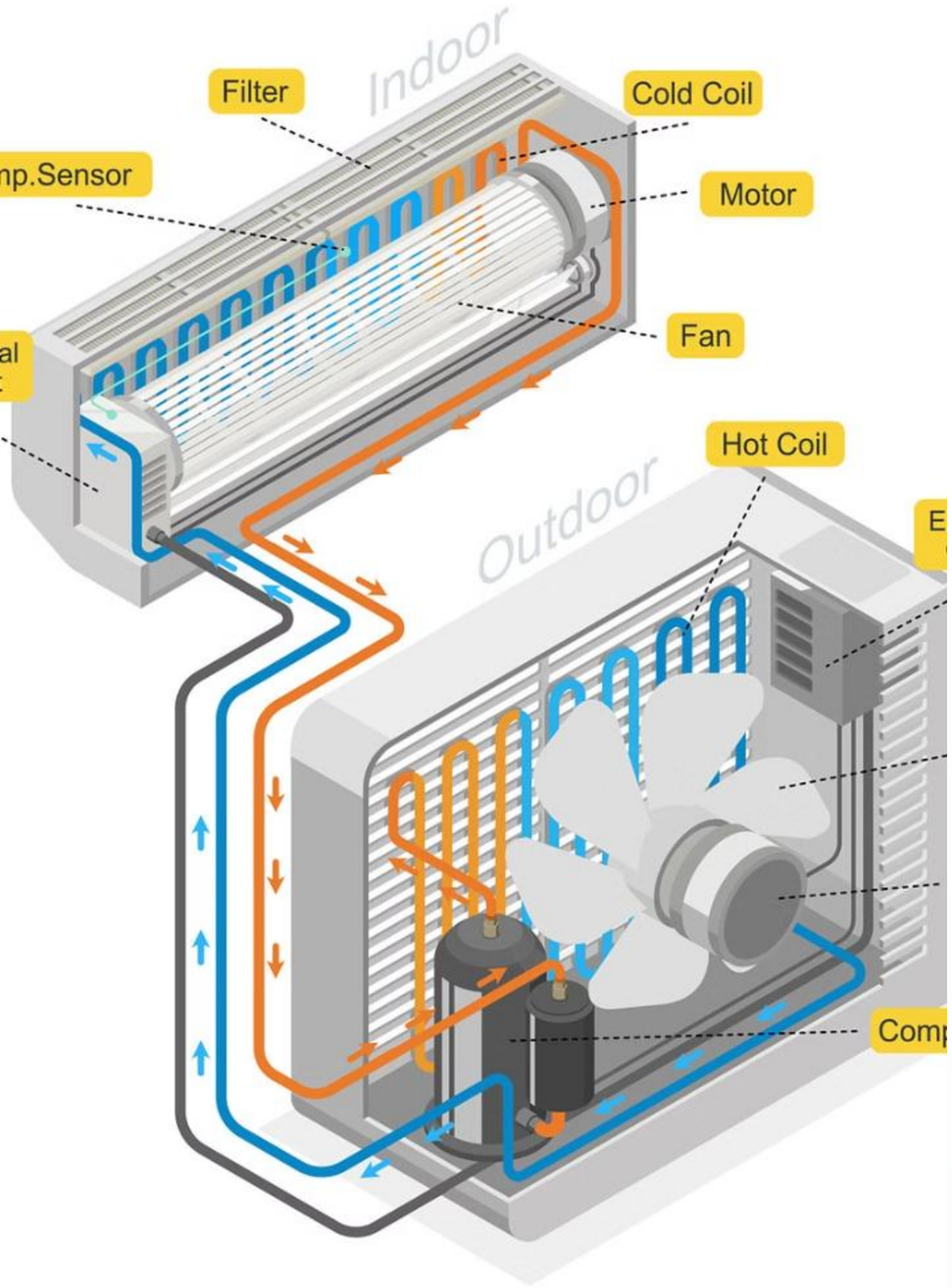
Not so high that the generator is scorched

Draft Protection

Not so low that flame is blown out by drafts

Minimum Setting

Low enough to prevent over-cooling



Air Circulation Requirements

Unrestricted Flow

Air flow to and from the unit must not be restricted

Proper Spacing

Maintain correct distance from walls

Clean Cooling Fins

Keep condenser and absorber fins free of dirt and lint

Clear Pathways

Remove foreign objects from ventilation spaces

Flue System Importance

1

Heat Transfer

A clean flue ensures rapid heat transfer from flame to generator

2

Efficiency

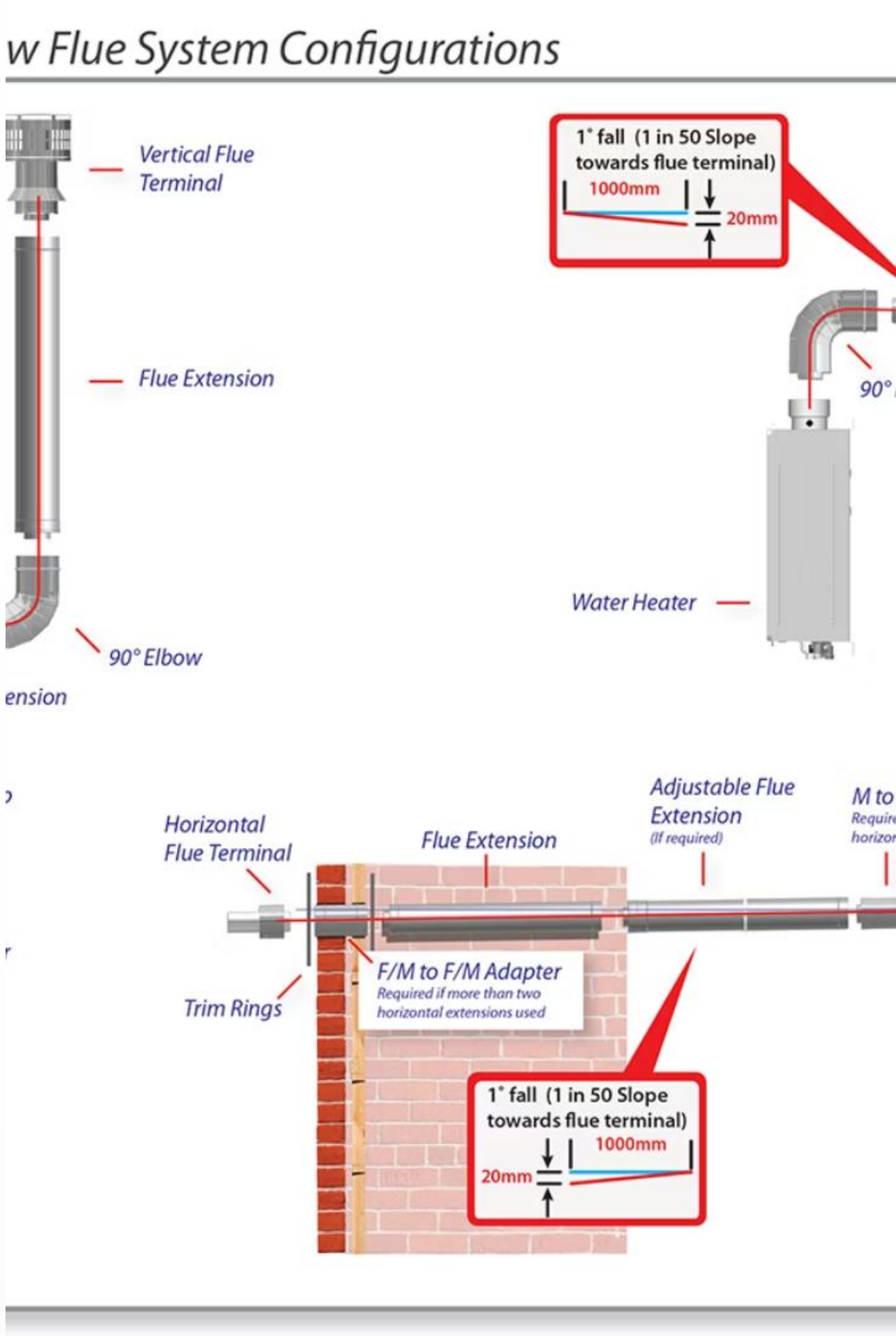
Reduces gas consumption by improving system efficiency

3

Safety

Prevents incomplete combustion and carbon monoxide generation

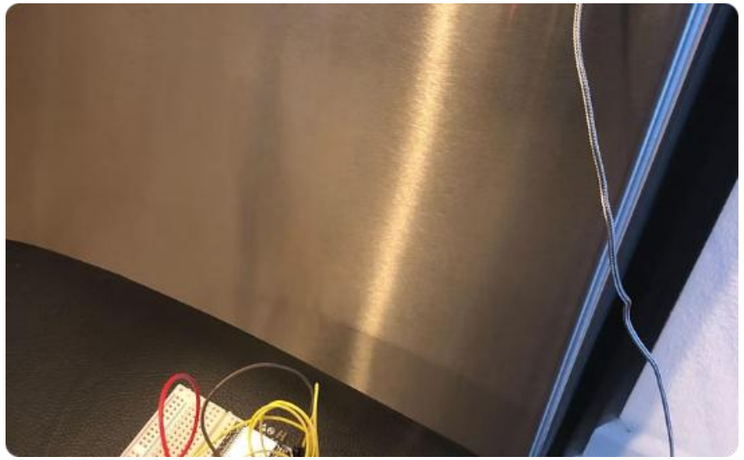
After a period of operation, the flue may require cleaning. A dirty flue causes a reduction in rapid heat transfer from the gas flame to the generator body.



Signs of Refrigerant Leaks

Sodium Chromate

Bright yellow deposits on tubing indicate a refrigerant leak. This chemical solidifies when exposed to air and is a definitive sign of system leakage.



Temperature Anomalies

Unusual temperature patterns, such as a warm interior with frost on condenser fins, can indicate an internal leak in the evaporator.

Odors

Distinctive ammonia odors outside the refrigerator often indicate a leak in the absorption system that requires immediate attention.

Carbon Monoxide Safety

Weekly Testing

For units supplied with a CO sensor, manufacturers recommend testing the alarm operation at least once per week during use or if the appliance has been turned off for a period of time.

Soot Warning

Soot must not be present in the flue or baffle, as this is a sign of incomplete combustion. Should soot occur, contact the dealer or manufacturer immediately.

Clean Flue Importance

Regular flue cleaning prevents incomplete combustion and the generation of dangerous carbon monoxide (CO).

Flame Characteristics

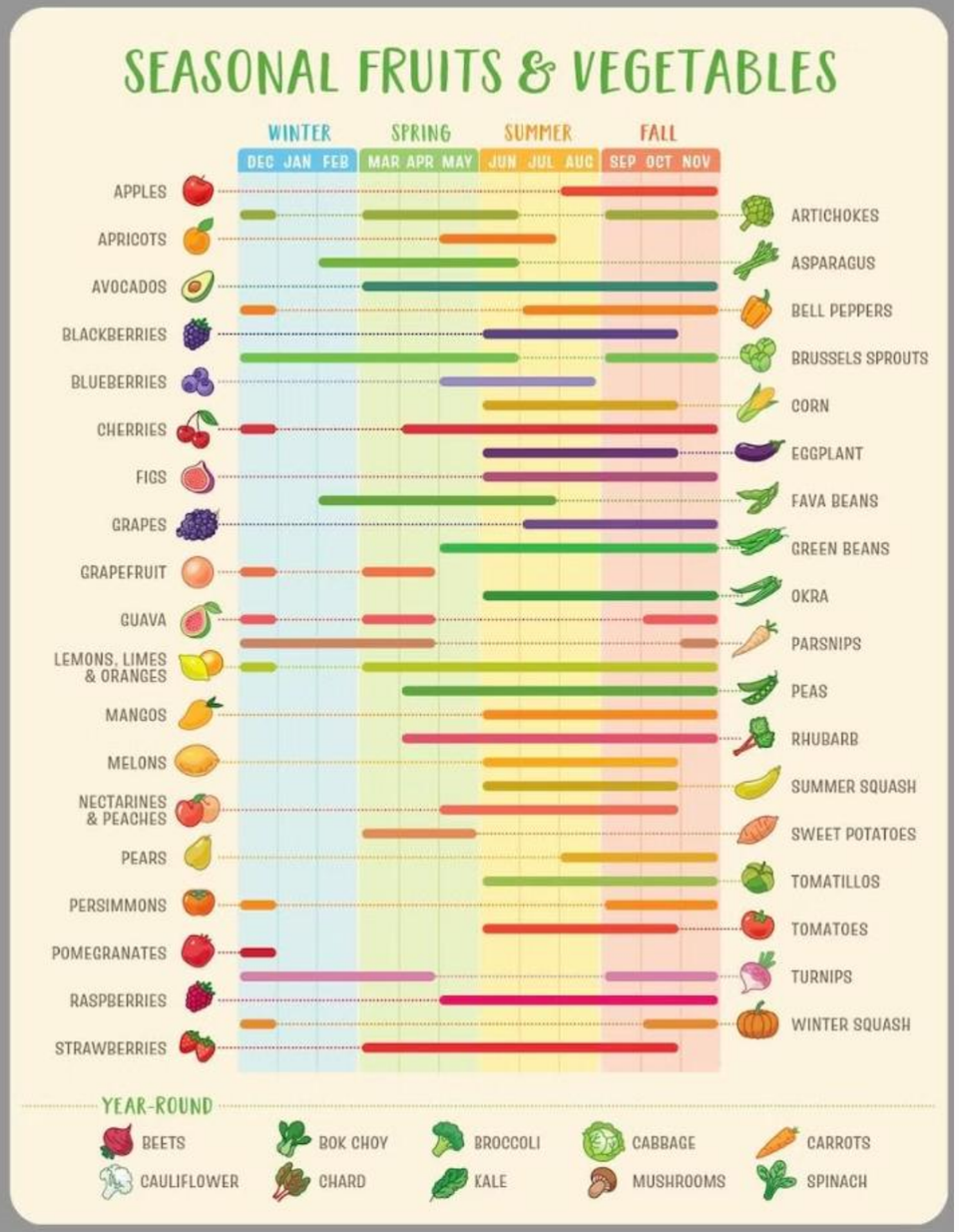
Proper Flame

- Blue in color
- Steady, not flickering
- Not impinging on any surface
- Proper size according to manufacturer specifications

Problematic Flame

- Yellow color indicates incomplete combustion
- Impinging on surfaces can cause soot buildup
- Flickering may indicate drafts or improper air mixture
- Too small or too large indicates pressure or orifice issues

If the flame impinges on a surface or is burning yellow, the generator and flue passages will become coated with soot and need to be cleaned for rapid heat transfer. Ensure that you do not damage the generator surfaces during cleaning.



Biannual Maintenance Schedule

Spring Service

Before summer season of heavy use

- Clean condenser fins
- Check flue system
- Test all components

Summer Operation

Regular monitoring during peak use

- Weekly CO sensor tests
- Monitor performance

Fall Service

Before winter or storage period

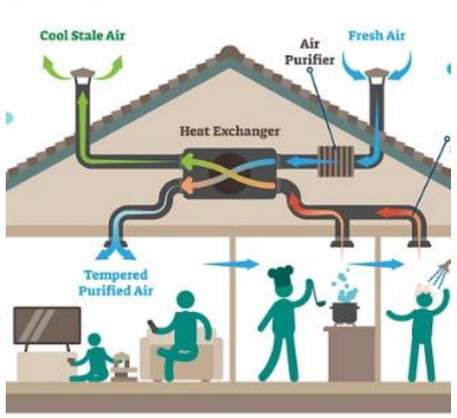
- Clean all components
- Check for wear and tear
- Prepare for storage if needed

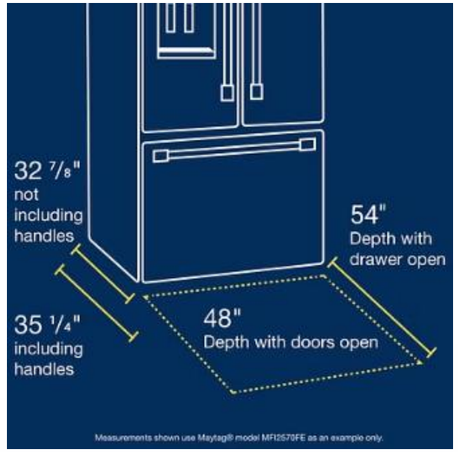
Winter Storage

If not in use during winter

- Proper shutdown procedures
- Ventilation during storage

Gradual Cooling Efficiency Factors





A gradual decrease in cooling efficiency can be caused by ventilation issues, heat input problems, off-level operation, lack of service and maintenance, inadequate repairs, or unauthorized field modifications.

Operating Temperature Timeline

1

Initial Startup

System begins cooling cycle

2

1-2 Hours

Initial temperature drop begins

3

4 Hours

Average time to reach normal operating temperatures

4

Troubleshooting Ready

System now at proper temperature for accurate diagnostics

The cooling unit must reach normal operating temperatures before troubleshooting can take place. The time frame to reach operating temperatures depends on ambient air temperature.

Flame-Failure Device Operation

Normal Operation

Flame heats thermocouple, keeping gas valve open

Flame Extinguished

If flame goes out, thermocouple begins to cool

Valve Closure

Distinct "click" as valve closes, stopping gas flow

Cooling Period

30-40 seconds of cooling time

Burner Maintenance Importance

Proper Combustion

A clean burner ensures complete combustion and prevents carbon monoxide formation

Efficient Operation

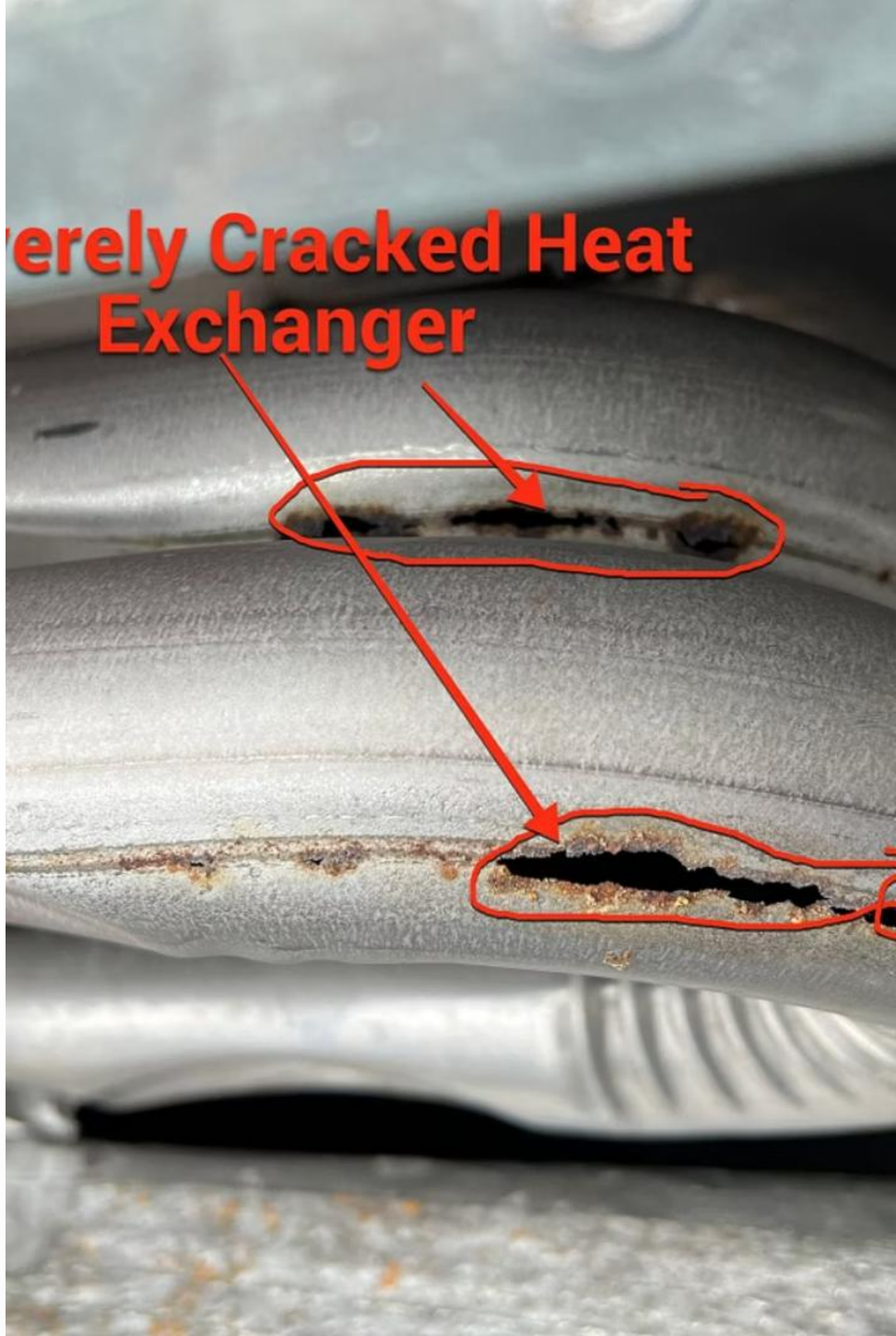
Maintains proper heat input for optimal refrigeration performance

Extended Lifespan

Regular maintenance prevents premature component failure

Cost Savings

Reduces gas consumption and prevents expensive repairs



Orifice (Injector) Maintenance

Removal Process

Disassembling the nipple holder with two open-end spanners can help take off the orifice (injector) for inspection and cleaning.

Cleaning Method

Clean the orifice with alcohol and compressed air to remove any obstructions that could affect gas flow and flame characteristics.

Proper Reassembly

Before reassembling, tap gently a few times on the gas tube leading to the burner to loosen any lint collected in the tube, then reassemble and tighten carefully.

Door Seal Importance

1

Temperature Maintenance

Prevents warm air infiltration

Moisture Control

Reduces frost formation

Energy Efficiency

Lowers operating costs

Poor gasket sealing on the door can lead to multiple issues including odors inside the refrigerator, rapid frost formation, and inefficient cooling. Regular inspection and replacement of worn door seals is an important part of maintenance.

Defrosting System Maintenance

Manual Defrosting Issues

Manual defrosting may be impossible or incomplete due to:

- Ice layer too thick
- Thermocouple (sensor) tip not in position

Automatic Defrosting Issues

Automatic defrosting problems can be caused by:

- Defective thermostat (or control board)
- Failed defrost heater
- Defective defrost safety switch

Regular maintenance of the defrost system components is essential for proper refrigerator operation and preventing excessive ice buildup that can impair cooling efficiency.

Customer Communication Tips

Ask Detailed Questions

Clarify customer complaint by asking questions to get as much information as possible

Use Technical Resources

Interpret customer complaint using manufacturer's service manuals

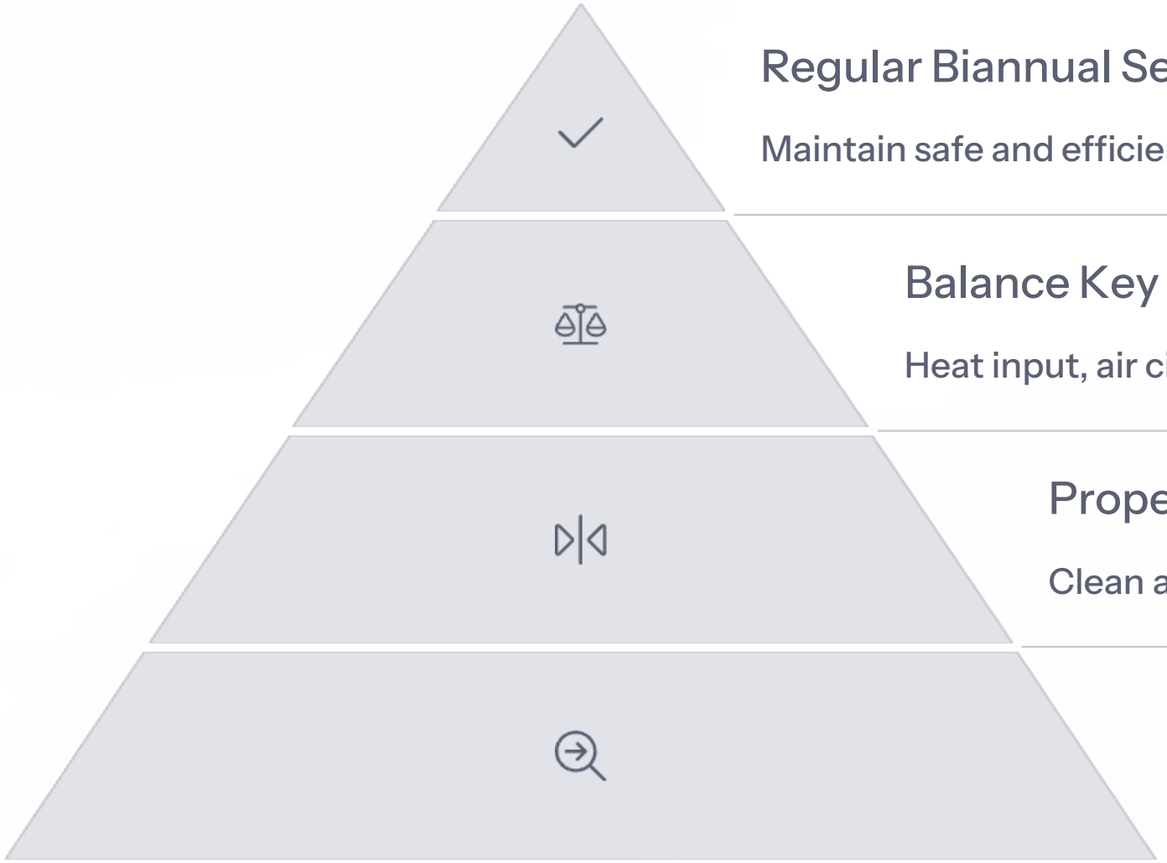
Systematic Testing

Identify potential faults and test components methodically

Document Findings

Keep detailed records of all tests and repairs performed

Maintenance Summary



Regular Biannual Service

Maintain safe and efficient operation

Balance Key Factors

Heat input, air circulation, and leveling

Proper Component Maintenance

Clean and test all critical components

Systematic Troubleshooting

Follow methodical diagnostic procedures

Proper maintenance of gas-fired absorption refrigerators requires attention to the three key factors: proper leveling, correct heat input, and adequate air circulation. Regular biannual servicing, especially before seasons of continued use, will ensure safe and efficient operation. When troubleshooting, always follow a systematic approach to identify and resolve issues effectively.