

***ABS Alaskan, Inc.***  
***Anchorage – Renton – Fairbanks***

## **Introduction To PORTABLE & REMOTE REFRIGERATION**

For simplicity in this brochure, refrigeration units are referred to as “refrigerators”. All of the information applies equally to refrigerators, refrigerator-freezer combinations, and freezers and to both upright and chest-style units.

### **What options do I have?**

There are two primary types of refrigeration methods used:

- 1) Ammonia Absorption – uses Propane or Electricity (AC or DC)
- 2) AC/DC Compressor – uses Electricity only

### **How does refrigeration work?**

Refrigeration methods utilize three basic concepts:

- 1) There is a direct relationship between pressure and temperature. As one increases (or decreases), so does the other.
- 2) The temperature (and indirectly pressure) on both the inside and the outside of a closed loop system will – given the opportunity – equalize, with the heat transferring from the area of higher temperature to the area of lower temperature.
- 3) Raising the pressure of a fluid raises its boiling temperature point – and, inversely, lowering the pressure lowers the boiling temperature point.

The refrigeration system consists of a thermally conductive fluid in a closed-loop pipe system. The fluid is cooled to a temperature below that in the food compartment. As the fluid in the pipe system travels past the food compartment, heat from the food compartment is absorbed into the fluid – lowering the temperature in the food compartment. The fluid temperature rises to a point greater than that of the ambient air. At which point it is then exposed to the ambient air and heat from the fluid transfers to the air – lowering the temperature in the fluid. And the cycle starts over.

Both methods require an infusion of energy at the beginning of each refrigeration cycle to create the temperature imbalance – they just achieve it differently. With the absorption method, heat is applied to the fluid (which also raises the pressure). With the AC/DC Compressor method, the pressure of the fluid is increased (which also raises the temperature). The attached drawings, while not technically complete, demonstrate the basic functioning of both methods in clear and simple terms.

### **How can I enhance the effectiveness of my refrigeration system?**

You can enhance your refrigeration system by keeping the refrigerator in a cool, shaded area (out of direct sunlight and away from other heat generating sources) and ensuring a good flow of cool air around the refrigerator to dissipate the heat. If you are using a refrigerator in an enclosed room, don't leave the room locked up, with all cooling turned off, and sitting in the sun -- the enclosed area will turn into a bake oven, which isn't good for *any* refrigerator! Also, plan your food storage within the refrigerator and know ahead of time what you want to take out of the refrigerator so that you can minimize the number of times you need to access the refrigerator and the amount of time that the refrigerator door is open.

### **ABSORPTION REFRIGERATION**

The Ammonia Absorption method (typically just called the Absorption method) uses external heat to operate and gravitational forces to circulate the fluid through the cooling system. In the **Boiler**, the heat source heats an ammonia mixture to a hot vapor. The **Condenser** reduces the temperature enough to convert the hot vapor to hot liquid. In the **Evaporator**, the pressure on the liquid is substantially reduced, causing the liquid to boil and evaporate, collecting on the system walls. The cool, evaporated ammonia draws heat from the food compartment, cooling the food compartment. The ammonia continues to the **Absorber Tank** where the accumulated heat is released into the atmosphere, and the cycle starts over.

Gas (propane) is typically used for this type of system as heating the ammonia mixture electrically requires a considerable amount of power (1-3 amps at 120 VAC and 8-23 amps at 12 VDC). Advantages are that there are no moving parts, propane may already be available for other appliances, and the refrigerator is fully functional year round – regardless of availability of electrical power. Disadvantages are that the refrigerator has to be level (at least half a bubble within the lines in all directions on the level), the method requires adequate ventilation to remove heat from the cooling unit, and the combustion of the propane creates residual fumes (carbon monoxide) which must be removed. For RV applications, propane may be readily available, but in some marine and remote power applications transporting and storing the propane may be much more expensive and difficult. Gas refrigeration makes sense in situations where electricity is unreliable, unavailable, or very expensive. This would include remote or isolated locations – for both personal and commercial applications. Gas refrigerators and coolers are popular for use with recreational vehicles (RV's), boats and cabins.

## AC/DC COMPRESSOR REFRIGERATION

With the AC/DC Compressor method, the cycle starts with the **Compressor**. The **Compressor** provides the pressure for moving the fluid through the system and (indirectly) increases the temperature of the fluid until it is a super-hot vapor. The **Condenser** releases much of the heat accumulated from both the food compartment cooling process and the compression process into the atmosphere, reducing the vapor to liquid form. The **Receiver Tank** reduces the pressure on the liquid, causing it to boil and evaporate. (With the **Expansion Valve** regulating the fluid flow and controlling the temperature.) The evaporation, which takes place in the **Evaporator**, substantially reduces the temperature of the fluid. Heat from the food compartment is then transferred to the cooled liquid, cooling the food compartment. The liquid continues to the compressor, where the cycle starts over.

The AC/DC Compressor method has become a much more attractive option with improvements in compressor motor efficiency (between 0.4 and 0.975 amps at 120 VAC and 3.5 and 6.0 amps at 12 VDC). Most high quality AC/DC refrigerators today use the Danfoss brand compressor. The refrigerator can be operated up to 30 degrees out of level and requires only minimal ventilation. The primary drawback to this method is providing consistent electrical power to the refrigerator. Although the compressor pumps today are very efficient and durable, they are a moving part and will eventually wear out and fail.

## DO YOU HAVE OTHER UNIQUE APPLIANCES?

Yes, we do! Here are some of the gas and electric appliances we have available:

- All sizes of propane freezers and refrigerators – both upright & chest
- Super-efficient electric refrigerators and freezers that run on both AC and DC electricity
- Super-efficient clothes washers and dryers – gas & electric
- High-efficiency propane “on-demand” water heaters
- Propane ranges and ovens
- Microwave ovens, compact dishwashers, compact kitchen combo units
- Much, much more !!!

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