Troubleshooting and Repair of Your Propane Equipment
(Water Heaters, Furnaces & Refrigerators)

INTRODUCTION

One of the key secrets to troubleshooting a piece of equipment is to have some idea about how it works. We usually know what the input and output are supposed to be, but have no idea how we get from here to there. A water heater takes cold water and delivers hot water using propane; a furnace provides hot air using propane; an air conditioner provides cool air using 120 VAC; a refrigerator provides cool and frozen food using propane or 120 VAC or sometimes 12 VDC; a generator provides 120 VAC from either gas, diesel or propane; a charger keeps our batteries working properly using 120 VAC or an alternator; an inverter changes our 12 VDC into 120 VAC; a solar panel helps keep our batteries charged using sunlight; etc., etc.

We take all of this equipment, stick it into a box, leave it outside all year long and subject it to extremely hot and cold temperatures. We dump water and dirt all over it and then periodically shake the heck out of it. No wonder our RV appliances and equipment constantly need care and feeding. Lots of little critters like the smell of propane so they build nests in the equipment that can block the flow of air or gas. Exposure to the weather and dirt can cause short circuits on printed circuit boards. Occasionally, manufacturers may have done a poor design or used an unreliable component which will eventually cause a failure. I know it's hard to believe, but some of us might actually not take care of our expensive RV systems (sometimes referred to as MAINTENANCE) resulting in failures at the most inopportune times.

Home appliances usually last for many years without continuous maintenance, but they live in a benign environment and with millions of each item sold, receive the ultimate in design for reliability and cost. Most of our RV equipment is designed to survive in the environment in which it has to live, but periodic maintenance is a requirement not an option. The "don't touch it until it goes bad" philosophy just does not work on RV's. Most of the equipment has specified periodic maintenance schedules, just like your tow vehicle or motorhome. It may be as simple as cleaning the area around the equipment, changing a filter or tightening an electrical connection. Read your individual instruction manuals, check the RV manufacturer's service and maintenance manuals and download any available appliance service information.

In this seminar, we are going to cover water heaters, furnaces and refrigerators. This is not intended to be a detailed step by step troubleshooting manual for a technician. We will provide a basic outline of how the equipment works, maintenance you should be doing on a routine basis and an outline of what usually goes bad. Many of you should be able to do the simpler repairs yourselves and gain some knowledge in order to make the decision when you need to visit a professional repair shop.

PROPANE APPLIANCES

Fundamental to any propane or natural gas operated equipment are the following items:

1. Uses the heat from burning gas
2. An electrically operated valve which turns on the gas
3. A method of automatically lighting the gas jet
4. The ability to turn off the gas valve if the flame goes out
5. A means of setting and/or changing the operating temperature
6. A turn off protective device if it gets too hot
7. Several protective circuits involving timing of turn on and turn off cycles
8. A good source of 12 volt DC power to run the circuitry
9. A source of propane that provides the correct gas pressure (11" of water)

Let's define a few terms:

Thermometer: Sensor that measures temperature and usually provides a visual reading

Thermocouple: Generates a voltage as a function of temperature (millivolt levels)

Thermostat: Opens or closes a switch as a function of temperature

Thermistor: Changes resistance as a function of temperature

eco or E.C.O.: Temperature activated electrical cut-off switch

I have two gas furnaces in my house that operate from natural gas. They are used in a zoned two area system. One is an original unit over 50 years old and the other, a much larger furnace that was replaced about 8 years ago. The older unit has a pilot which burns all of the time. The gas line goes into a valve which controls the main gas input for the furnace. A separate smaller gas line feeds around the gas valve through a small manual cutoff switch to provide the pilot flame. You open the small cutoff, light the pilot flame and then hold a spring loaded switch till the flame stays on. A wall mounted thermostat can now close a switch when the ambient temperature reaches the level you have set. This provides the final voltage to the relay controlled gas valve that turns on the furnace. If the flame goes out, the gas valve turns off and you must go thru a re-light cycle by resetting the spring loaded switch.

The newer furnace does not have a pilot flame but uses a direct-spark ignition that effectively turns on the main gas valve and lights it using an electrical spark. Once the preset temperature has been reached, the thermostat (inside the wall thermometer) opens and shuts off the gas supply. It has several electric circuit boards that control the turn-on and turn-off cycles. Home furnaces usually use 24 VAC which is supplied by a transformer connected to the 110 VAC. Our RV furnaces operate in a similar manner except for using 12 VDC to operate the gas valve and electronic circuits.

GENERAL

The following sections will consider the propane operated water heater, furnace and refrigerator. All of these are fundamentally the same in terms of how they operate in generating heat, controlling it and providing suitable protection systems. They all have similar gas systems and use a high voltage to create a spark that will automatically light the gas jet. If the flame goes out, they will wait till any gas fumes clear and then automatically re-light the appliance.

Good trouble shooters are worth their weight in gold to any service shop. You usually find two basic types: (1) those who learn how a system works and understand the different functions which must occur and (2) those who have fixed so many systems over the years and learned what usually goes wrong. The technician who has fixed a hundred refrigerators can look at a problem, check the model number and go right to the defective component. He may not know how the complete fridge actually works or the operating principles behind it, but who cares. He quickly finds the bad component, has it in stock (because he knows what usually fails) and makes the repair. Actually fixing the problem (replacing a bad component, tightening a wire, fixing a ground lead, etc.) takes a minimal amount of time and effort. Determining the problem (troubleshooting) is what is most difficult and takes the longest.

Since it is not likely that we will be spending enough time to gain years of experience in fixing our RV appliances, our best approach is (1) learn how it works, (2) learn how to isolate the problem, (3) learn how to make some simple safe tests and (4) learn when to stop and get an expert.

The first step is to clearly define what the problem is. This is not always as easy as it sounds. My refrigerator does not work?? On gas? On electric? The freezer is not cold enough? Food in the main box is too cold? Ice cubes are not freezing? Etc., etc.

Check carefully and determine what is working correctly. If the food is spoiling, put a thermometer in the fridge freezer or the main food box and determine the actual temperature. Check the ambient temperature when you measure the box. Make sure your refrigerator is set on high if it is a hot day.

Being able to succinctly state the problem as well as any applicable environmental factors is needed regardless of whether you tackle the problem yourself or take it to a repair shop. The better you define the problem the less trouble shoot-