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Gas Furnace Basics

- On gas powered furnaces, the thermostat tells the circuit board when there is a call for heat.
- Thermostat calls for heat.
- Thermostat relay or time delay relay is energized and allows power to the blower.
- Blower motor runs up to speed.
- Sail switch closes at 75% of rated blower speed.
- Power goes through the limit switch to the ignition control board.
- The control board begins trial for ignition, opening gas valve and initiating ignition spark.
- Burner ignites.
- Thermostat reaches setting and opens.
- Burner shuts down.
- Fan runs briefly to cool furnace.

Definitions:

- **Sail Switch** - Micro switch with an arm that extends into the blower air stream which closes when the blower reaches approximately 75% of its rated speed. Also called an air prover switch.
- **Limit Switch** - Safety switch, a normally closed switch that opens if it gets to hot, opening turns off power to the gas valve and ignitor board
- **Fan Switch** - A normally open switch that closes at a preset temperature, causes the furnace to run for a short time after the thermostat opens, allowing the furnace to cool down.
- **Time Delay Relay** - Same function as fan switch, only has its own heater, also used instead of a thermostat relay in newer models.
- **Ignitor Electrode** - Similar to a spark plug, 2 versions, 3 probe (remote sense) or 2 probe (local sense.)
- **Ignition Control Board** - When powered, initiates gas valve opening and spark sequence which lasts approximately 7 seconds. Older models are 1 try, thermostat must be cycled off for at least 10 seconds before another ignition cycle is attempted. Newer boards are 3 try, will attempt to ignite 3 times at approximately 60 second intervals.
    - Some furnaces now come with a fan control ignition board. Fan control boards will shut the blower down if ignition does not occur after 3 attempts. Some models will shut down the blower and wait an hour and recycle, if ignition does not occur the furnace is then shut down. Older DSI furnaces, with some exceptions can be upgraded to fan control. See Fan 50 Plus.
- **Gas Pressure** - LP gas pressure must be 11“ of water column (6.25 oz per sq. in.), checking and adjusting requires a manometer.

Gas Furnace In Depth

Using the RV furnace requires adequate electrical power, sufficient LP-gas supply and thermostat programming. However, while the furnace appears basic on the surface, the system is actually an intricate series of components designed to operate in concert. Becoming familiar with this heating “chain of command” should assist you in learning how to keep the RV comfortably heated, and help you troubleshoot any potential problems that may arise.

A variety of electrical components comprise the RV furnace system. In addition to the motor and blower, a relay, circuit breaker, limit switch, sail switches and circuit board are all parts of the furnace system that require adequate 12-volt DC power. Whether you are relying on house batteries, the generator, or shore power, test the source to confirm proper amperage is supplied. Operating the RV furnace on voltage less than 10.5 can be compared to sprinting straight up a steep hill without sufficient energy. It could cause the furnace motor to overheat, damaging

the entire system. Providing the furnace system with amperage exceeding 13.5 volts is like turning around and running quickly down that same mountain. The excess speed will likely create imbalance and accelerated wear. So remember to authenticate adequate electrical power to protect the furnace, as well as the rest of your RV components.

Engaging the furnace will necessitate performing a few simple tasks. Begin by turning the LP-gas valve to the on position. The valve is located at the tank. Tanks equipped with a remote fill require solenoid power. Once activated, the solenoid power will produce a click and illuminate the red power light. Turn on the battery cut off switch at the entry door. The wall thermostat must be turned on, mode button programmed to the furnace setting, and the desired temperature set by using the up and down arrow buttons.

Once interior heat reaches the chosen temperature, the furnace system will go into a “sleep” mode. When temperatures fall below your pre-set limit, the furnace will engage and operate until again reaching the preferred limit.

The moment the furnace is turned on, a path of power is opened between the thermostat and circuit breaker. The thermostat controls the operating system by sensing room temperature to determine when heat is needed. The circuit breaker works to prevent the motor from drawing excess amperage. A relay sends current to the motor. Once power is received, the motor engages the blower to create circulating air. This process occurs in approximately twenty seconds.

Two safety features are installed within the furnace system. Sail switches confirm adequate airflow prior to ignition. A heat sensitive limit switch, similar to the pressure activated limit switch used to engage lighting on the refrigerator, bay compartment and oven, disengages the electronic ignition system to prevent over heating.

The wall thermostat is a crucial component of the furnace system. The on/off switch at the thermostat sends power to a circuit breaker. Occasionally, you may find that you have inadvertently moved that switch and may try to correct the error by moving the switch again. This quick series of electrical spikes to the circuit breaker may cause the breaker to trip. If the wall thermostat is rendered inoperable, include a check of the circuit breaker while troubleshooting the problem.

Assigned with the critical task of limiting amperage draw, the circuit breaker is an important part of the furnace system. Breakers often trip because there is a problem with the system. Begin by checking the RV electrical source to determine if adequate voltage is being supplied. Short spikes to the power will usually not cause a breaker to trip, but too little or too much power is a common cause of circuit breaker malfunction. Once the breaker has been reset, thoroughly investigate all amperage draw to determine whether voltage use is overloaded.

When replacing the circuit breaker of the furnace system, only use an identical replacement. Mounted externally, this circuit breaker is rated as “slow Blow” to withstand excess heat. Additionally, since the circuit breaker performs the critical job of regulating voltage use, specific amperage is required.

The thermostat heat sensor regulates the need for heat. To ensure proper temperature sensing, the thermostat should be clear of obstructions that may generate excess heat such as wall hangings or items propped against the wall.

Providing a host of functions to the RV furnace system is the circuit board. A timing circuit within the board engages the blower to purge air from the chamber. The circuit board also sends current to open the gas valve. Some systems include a manual switch to control this function and that switch must be in the “on” position for the valve to open. Once the valve is extended, the circuit board will then send a high voltage spark to the electrode at the burner. If the circuit board does not sense the presence of flame in six seconds, the circuit board will retry two more times. If flame is not achieved in three tries, the circuit board will lock down for one hour before again attempting ignition.

Heat ducts are used to move air throughout the RV. Airflow can be maximized by keeping the vent openings clean

and clear of dust and debris. Prevent placing obstructions in front of heat ducts as this will restrict air movement. In the event maintenance is performed at or near the heat ducts, carefully double check the work to confirm that all unattached heat ducts have been properly reattached.

Annual maintenance of the furnace system involves careful cleaning and inspection. Repairs to the furnace system should be performed by a qualified service person. When traveling with pets, or in regions that create excessive dust, frequently clean the control compartments, burners and circulating air passageways of the furnace system.

Eliminate dirt and debris from the control compartment and remove corrosion from the burner using a wire brush, particularly after storage when insects are likely to have built nests near the burner tube. Occasionally inspect and clean the air wheel to prevent damage from obstructions. The exterior air vent is easy to access for frequent cleaning and removal of debris. Never store cargo inside the exterior furnace air vent and risk the loss of necessary air flow to the system. In the event that the combustion chamber becomes clogged with dirt and debris, have a qualified technician remove the chamber to flush away obstructions.

Annually inspect all components. Check the control compartment for loose or disconnected wires. Adjustments to the burner are rare, and should only be done by a qualified technician and signs of cracking or holes appearing in the combustion chamber should not be ignored. They will require prompt replacement of the chamber itself. Confirm that all gaskets still have a tight seal and discard any loose gaskets, replacing them with new ones. View the overall system to ensure the furnace is firmly in place without sags, cracks or gaps.

Remember that adequate amperage is necessary for the furnace to operate at full capacity. If you are regulating the use of electrical power, set the temperature lower to reduce system cycling. Be attentive to maintenance of the system and you will discover that the RV furnace is a reliable and efficient heating system.

Originally by Marks RV (no longer active), Furnace Trouble Shooting Guide