Fire Detection and Suppression System

for engine and generator compartments

Owner's manual
with installation instructions

Revision 1.5 (11/1/07)

The major system components:

EG-400™ or
EG-400-5™
Fire *detection* system

RValve™
Heart of the fire
***suppression* system**

2.5 Gallon pressure container plus Cold Fire® concentrate

Special swirl nozzles

The complete system includes:

- EG-400™ or EG-400-5™ fire detection monitor
- RValve™ fire suppression activator
- 2.5 gallon pressure vessel
- Three swirl nozzles and associated hardware
- 32-ounce bottle of Cold Fire® concentrate (see below for more information)

The Owner will need to furnish:

- 3/8 inch cooper tubing (DOT tubing can be use for some of the plumbing runs) for connecting the RValve™ to the engine and generator compartments
- 18 or 22 gauge twisted pair cable (commonly called communication cable) for connecting the sensors to the EG-400™, connecting the EG-400™ to the RValve™ and connecting the EG-400™ to a 12V power supply
- Mounting and securing hardware

Optional equipment:

- "Bosch type" automotive relay and socket for activating other functions such as generator shut down and propane shut-off
- 6062 Generator Shut-down Module
- Propane detection/shut-off system that can be activated by the fire suppression system

RV Safety Systems

www.rvsafetysystems.com
888-349-0704

Our Business is Your Safety and Peace of Mind!

The System

This system is designed to continuously monitor the engine and generator compartments' temperatures. The generator can now be operated when you are away from the RV without fear of losing your valuables in a devastating fire. The system can be used to shut-down the generator and/or shut-off the propane supply.

The two major components of the system are the EG-400™ (or the optional 5 sensor EG-400-5™) fire detection system and the RValve™. They are described below.

EG-400™ or EG-400-5™

The EG-400™ is the fire detection system. It was developed by RV Safety Systems. It is an active alarm system which continuously displays the selected compartment temperature and provides an audible alarm as well as triggering the RValve™ and fire suppression system if a fire is detected. Major features of the detection system are:

- A ***fail-safe and reliable*** device designed to continuously monitor the engine and generator compartment temperatures. The digital readout assures the owner that the system is functioning properly.
- Two levels of alarms to give an ***early warning*** of potential problems.
- The monitor has a relay which activates the RValve™ and the fire suppression system.
- Each compartment low-level (or early warning) alarm can be set by the owner, based on history of that compartment's temperature.
- System will detect wiring problems in the sensor wiring (shorts or open circuit).
- Can be easily installed.
- Complete details at: ***http://www.rvsafetysystems.com***

The optional EG-400-5™ fire detection system allows the owner to monitor three additonal temperature channels. These channels are for information only and do not activate the fire suppression system

A complete installation manual is furnished with the EG-400™/EG-400-5™ and that information is not included in this manual. The manuals can be downloaded from: http://www.rvsafetysystems.com.

RValve™

The RValve™ is the heart of the fire suppression system. It was co-developed with Safecraft Inc., a leader in developing fire suppression systems for racing and military vehicles.

The valve has a proprietary design which incorporates a high-flow spool valve. The valve is activated electrically by the EG-400™ or EG-400-5™, if a fire is detected. It can also be mechanically activated in the event of a major electrical system failure.

In addition to the fire detection monitor and the RValve™, the system inculdes an industry standard 2.5 gallon pressure vessel for the Cold Fire® fire suppression material and three special swirl nozzles for the two compartments (one for the generator comapartment and two for the engine compartment). The system also includes miscellaneous plumbing hardware for connecting the fire suppression components.

Warranty and Warning Information

Warranty: This system is warranted for a period of one year from the date of purchase. The warranty covers parts and workmanship. The warranty does not cover damage occurring from improper use/handling or incorrect installation. The owner must contact RV Safety Systems for approval to return the defective unit.

Warning: Prior to putting the system into service, it must be tested. The test procedure is described in this manual. Failure to perform these tests could result in a non-functioning system that will fail to suppress a fire.

Warning: If an engine fire is detected, the engine must be shut off immediately to avoid flooding the compartment with oxygen and risking the possibility of a flash back of the fire.

Warning: It is very important that the owner frequently check the digital readout and LEDs on the fire detection monitor to make sure that the unit is on, is working properly and that no error codes exist. When power is first applied to the unit, the LED's should light and the "speaker" should sound a quick alarm. Failure to verify that the unit has power, that the unit is monitoring the compartment temperatures, and that the speaker is working could result in a situation where the unit does not detect or notify the owner that a fire exists in the engine or generator compartment. The unit may also fail to trigger the RValve™ if the EG-400™/EG-400-5™ is not operating properly

Warning: The owner must inspect the pressure gauge on the RValve™ prior to starting a trip. It is strongly recommend that the gauge be checked daily. A system that does not have proper pressure will result in loss of fire extinguishing capacity. Loss of fire extinguishing capacity will result in major damage and possible injury if a major fire occurs.

Warning: If the fire suppression system has discharged the fire suppression material, the system must be recharged immediately.

Installation

Location of pressure vessel and RValve™ valve:

The RValve™ and pressure vessel will generally be mounted in a bay. This will provide protection from freezing and will permit easy access for system inspection and maintenance. The pressure vessel must be mounted vertically and properly secured. The RValve™ can be mounted horizontally, but the preferred mounting is vertically with the emergency mechanical knob located at the top.

An alternative location could be a closet in the RV. This would also offer protection against freezing and would permit easier mechanical activation in the event of a major RV electrical system failure.

Plumbing:

The system is provided with brass compression fittings for 3/8 inch diameter flexible copper tubing. This makes the connections easy to make and does not require special tools. Each fitting can be installed with the use of two wrenches.

DOT airbrake tubing and fittings (3/8 inch) may be used for plumbing most of the system. However, copper tubing must be used within the engine and generator compartments to assure plumbing integrity in a fire. Fittings for the DOT tubing are not included with this kit. A good source for the tubing is:
http://www.mcmaster.com/ (search for DOT tubing).

The system will be plumbed with one line to the generator compartment and one line to the engine compartment. Within the engine compartment, the system will have a "T" installed so that two swirl heads can be installed. All tubing must be properly installed and supported to avoid flex fatigue failures. Care must be taken to assure that the copper lines are not kinked.

For generator systems that have slide-out quiet boxes, the plumbing will have to include a flexible connection. If DOT tubing is used, it is possible to take advantage of the flexibility of the tubing to facilitate generator movement. If copper tubing is used, the system will need to include a flexible hose. Good quality 3/8 industrial hose with a pressure rating of at least 100 PSI is acceptable. The hose (or DOT tubing) should be properly coiled so that no kinking or strain on the hose, fittings, or tubing will occur when the generator box is moved out of position. RV Safety Systems has an inventory of acceptable hose. Call us for information.

.

Plumbing (Cont.):

The generator box will have one swirl head and the engine will have two swirl heads installed.

The generator head should be located as high as possible and as close to the center of the box as possible, with the head positioned to spray down of the engine/generator head. An option is to mount the head in the horizontal position in the side of the generator box. If this is done, the head should be mounted in the center of the side panel with the head aimed at the engine and generator head.

The engine swirl heads should be mounted as high as possible in the compartment. The two swirl heads should be mounted to give maximum coverage of the engine compartment. Consideration should be given to the fact that the swirl heads produce a fine spray. If the engine continues to run, the air from the radiator fan could alter the spray pattern. Some location adjustment could offset the affect of the radiator fan.

Note: all fittings MUST be tightened using two wrenches so that damage does not occur to the components. This is especially important when installing the tubing on the RValve™ .

Wiring:

Wiring of the EG-400™/EG-400-5™ should be done according to the installation manual included with the unit. Since the EG-400™/EG-400-5™ must continuously monitor the generator compartment, the power supply source must always be on when the engine and/or generator are on. Strong consideration should be given to selecting an always-on supply so that there is no opportunity to forget to turn the system on. The electronic components in the detection system are very robust and the system can be left on full time during periods when the vehicle is being used (non-storage periods). A switch can be installed in the circuit to shut the unit off during storage periods.

Wiring for the RValve™ should be done with at least 22 gauge wire. The wiring diagrams and further details are presented in the monitor manuals and later in this manual.

Because of the devastating results from an unattended generator fire, it is strongly recommended that the system include generator and propane shut- down functions. This can be accomplished using the optional “Bosch type” relay shown in the optional wiring diagram (Figure 2). Onan generators can generally be shut-down with our optional 6062 module. Propane systems can be shut-off via existing solenoid valves, if so equipped, or via our propane detection/shut-off valve system.

Installation (Cont.)

Charging the system with Cold Fire®:

Note: prior to charging the system, the testing procedure must be performed. That procedure is describe later in this document. During the testing procedure , water should be used (no Cold Fire® concentrate added).

The pressure vessel used for this system is a commercially available stainless steel unit that is typically used as a fire extinguisher. A special adapter is furnished to allow the unit to be plumbed to the RValve™ with 3/8 inch copper tubing (or DOT tubing with proper fittings).

After the tubing from the vessel to the RValve™ is removed, the top of the vessel will be unscrewed and removed so that tank can be filled with the fire suppressing material. Eight quarts of distilled water will be poured into the vessel first. To that, the contents of the 32 Oz. Cold Fire™ concentrate bottle should be added slowy (to prevent foaming). The top of the container will then be reinstalled. Because the top of the container has a O-ring seal, some rotation of the top might be required to complete the sealing process. Care must be taken to make sure no dirt enters the vessel, as it could clog the swirl nozzles or damage the valve.

Cold Fire® is a superior fire suppression material, but it is a water-based solution. The system can be made freeze proof by adding *potassium acetate* to the water component of the mix. The freezing point can be reduced to –76º F by using a 50% solution (by weight). A more practical concentration is 35% which results in freezing protection to –22º F. The following can be used to mix the solutions:

- 50% Solution (-76º F): use 10.8 pounds of dry powder PA and add water to make two gallons.
- 35% Solution (-22º F): use 7.0 pounds of dry powder PA and add water to make two gallons.

Potassium acetate is classified as “non-hazardous” according to MSDS information. Making the mixture will require quite of bit of stirring. The mixture should be allowed to sit for several hours to assure that the dry powder is fully dissolved.

The handle that activates the pressure vessel/fire extinguisher must be secured in the open or activated postion. The vessel is supplied with the valve handles bolted in the open position.

Installation (Cont.)

Charging the system with Cold Fire® (Cont.):

The pressure gauge and Shrader valve for the pressure vessel have been removed to assure that all pressure functions are done via the RValve™.

The system **must** be charged with 100 PSI air through the Shrader valve (tire-type valve) in the RValve™. Charging the system through the RValve™ postions the spool in the valve in the proper postion. The design of the valve is such that it will requre up to a minute to charge the system. Take your time and make sure the pressure stabablizes at 100 PSI after removal of the pressure hose. It is best to charge the system to the high side of the green area on the gauge.

After the system is pressurized, the plumbing from the vessle to the RValve™ should be checked for leaks. If leaks are present, bubbles from the Cold Fire® will be obvious. If leaks are present, the fittings should be tightend using **two** wrenches.

Testing the System

The components of this system have been fully tested. In addition the system design has been validated via actual testing using a generator box and pans of diesel fuel/gasoline mixture. The system test produced results that were actually better than the expectations of the design.

However, is is imperative that the system be tested after installation and prior to placing the system in operation. The following steps must be performed during the testing of the system:

1. The system must be installed according to this manual and the EG-400™/EG-400-5™ manual.
2. Power should be applied to the EG-400™/EG-400-5™ . The system will go through a brief self-test. During this test, the LEDs will all light and the spearker will sound an alarm. If the system does not perform the test, try repeating this step. Failure of the system to respond to this test should be reported to RV Safety Systems.
3. Once the self test is completed, the digital readout for both the engine compartment and generatror compartment should be observed to determine that the temperature reading seems appropiate for the conditions. Also check to make sure that no sensor wiring error codes ("SHO" or "OPE") are displayed.
4. The pressure vessel should be charged with two gallons of water (only). The system should the be presurized to 100 PSI via the RValve™.
5. The following steps will requre two people.
6. One person should observe the EG-400™/EG-400-5™ while the second person applies heat to the temperature sensor in one of the compartments. The heat source should be an industrial heat gun. It is possilbe to use a propane torch if extreme caution is exercised to *very slowly* heat the sensor and not ignite any of the surrounding material)
7. When the EG-400™ detects a sensor temperature of 250º F, the first-level alarm should sound. The 250º F setting is the preset first level alarm that will be adjusted later by the owner after history suggests a temperature that is slightly greater than the highest operating temperature of the specific compartment. When the EG-400™ detects a temperature of 400º F, the system should sound a more "aggressive" alarm and the system should discharge in both the engine and generator compartments. It will take 2-3 seconds for the water to fill the lines and for the discharge to begin. The alarm can only be silenced by removing the power from the system.
8. During the discharge, the spray pattern of the swirl nozzle(s) should be observed to make sure they are aimed properly. With 2 gallons of water, the discharge time should be approximately 30-40 seconds. Please note, because of the design of the valve, a slight amount of water will be discharged from the valve during the test. This is normal.
9. The test should be repeated for the other compartment to make sure that the sensor and spray pattern are acceptable.
10. If the system is wired to shut-down the generator or propane, that function should be tested during the system testing. This is done with the generator running and the propane turned on. After the test (while the alarm is still on) the propane should be turned off by the system (solenoid valve closed) and the generator have been shut down.

Wiring Diagrams

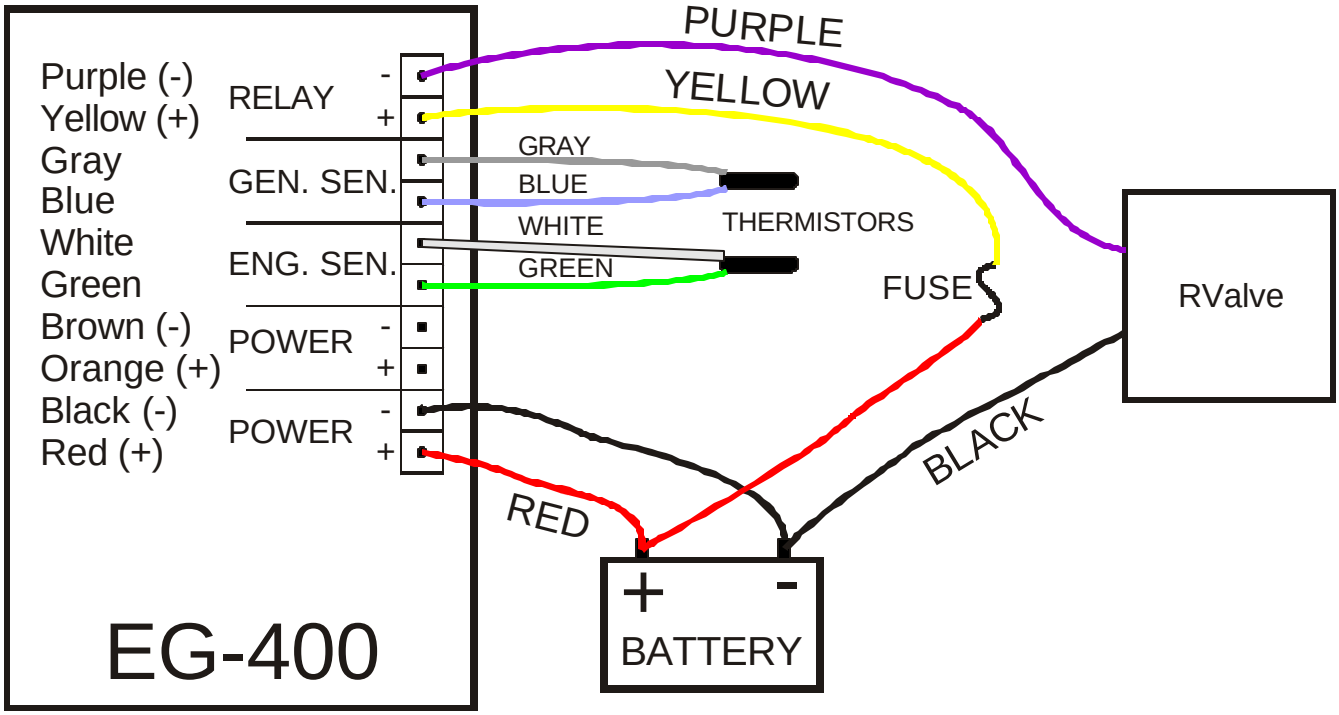

Figure 1.
Simple Installation

This installation will be used to trigger the fire suppression system in the event of a detected fire. Figure 2 shows an optional circuit that uses an optional relay that can perform additional functions upon detection of a fire.

For the circuit in Figure 1, power to the EG-400™ should be made with at least 22 gauge wire. Note that polarity is important. No fuse is required for the EG-400™ power supply since it is internally protected. Power should be supplied from a non-switched supply so that the system is operational at all times. The optional power supply (orange and brown wires) does not need to be wired.

The sensors should be wired with 22 gauge twisted pair wire per the EG-400™/EG-400-5™ manual (these connections are not polarity sensitive).

Wiring for the RValve™ must include a 2A fuse. The installation is polarity sensitive. The yellow wire must be connected to the positive side of the battery. Power for the RValve™ must be from a non-switched supply so that the suppression system is always active.

Wiring Diagrams (Cont.)

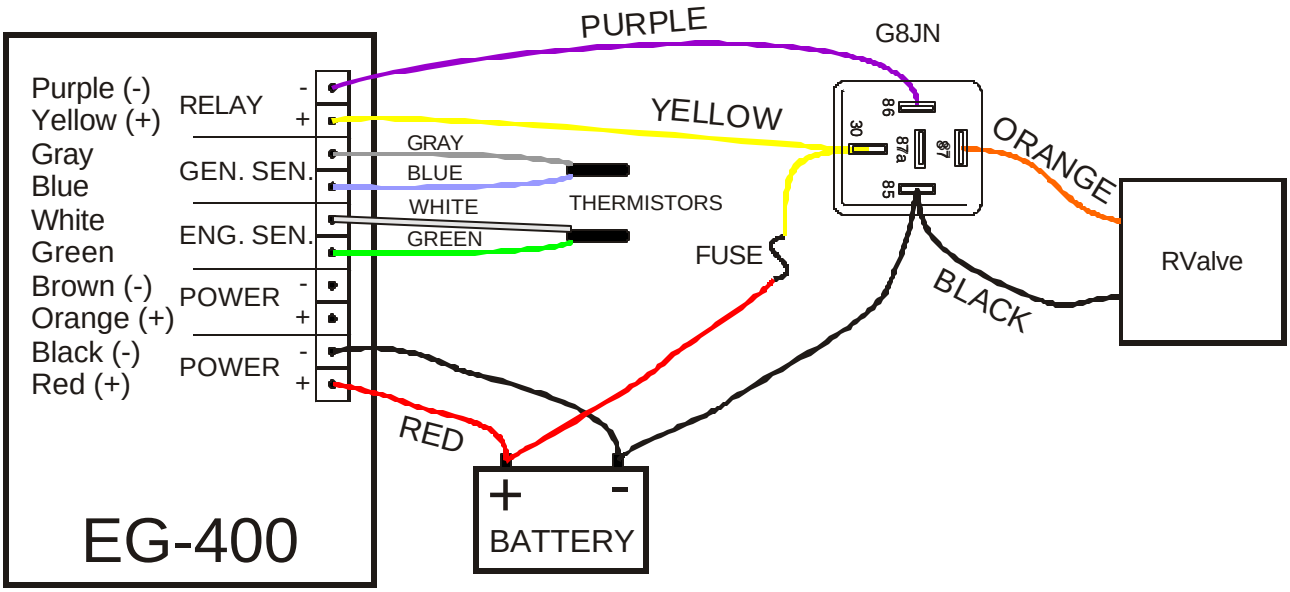

Figure 2
Optional wiring diagram
(provides ability to shut the generator and/or propane off in case of a fire)

This optional diagram is provided for the owner who wants to have the system shut the generator or propane off in the event a fire is detected. While the wiring is more complex, this option offers maximum protection.

This option utilizes a "Bosch type" automotive relay that has both normally open and normally closed circuits. The relay is an option for the system. The "Bosch" relay can be used to control other relays as well. However, the EG-400™ dry contact relay is rated at 0.7A and will only drive one "Bosch" relay. Other relays must be controlled by the first "Bosch type" relay in the system. If additional relays are used, each must be properly fused.

For this system, the fuse will need to be sized for the amperage that will be required by the device being controlled by the auxiliary relay.

Many generator manufactures use a momentary switch to connect the stop lead to ground in order to shut down the generator. If your generator has that kind of system, our 6062 module can be used to stop the generator.

Propane can be shut off via the solenoid valve used on some vehicles or via the propane detection/ shut off system we offer.