

Cargo Heater (RV3000) Repair

NOTE....Due to the potential Liability Issues, the information presented here is an OPINION.

The owner has the responsibility to determine if the repair is appropriate.

IF you are NOT interested in all the Technical and Experimentation verbiage....then scroll past and go to THE FIX...otherwise, read on.

Background

The RV3000 or labeled Cargo Heater has been in production for at least 10 years....based on feedback from owners. The original units did not have a secondary Failsafe or Thermal Overload device. The current heaters (circa 2006 & Newer) were modified by the manufacturer and a "Single Shot" Thermal Overload Fuse was added. It is a 121 d. C / 15 Amp component. Based on conversation with a Vendor "Quality Control" representative, the Single Shot was added, as an afterthought. The Engineer that modified the circuit is no longer with the company and there is no technical support or design engineering documentation now. The manufacturer advises that all the returned nonfunctional (Air Flow, but no Heat) units have a failed Single Shot. The manufacturer does not appear to be interested in any modifications and has not reached out even though contact information has been provided.

Many individuals have used a Radio Shack Thermal Fuse - 225 d C / 10 Amp and crimped it in. Reports are that it is marginal. Whether it is the amp load or installation or whatever is not known. The fuse had been discontinued and comparable part numbers are selling up to \$20.....versus the old RS \$1 price. This substitution is not considerable reliable.

Heater Operation

A defective heater was provided by a member. It had been repaired and another member. Frank McElroy did the actual experimentation. Frank and I corroborated and exchanged theories and after considerable testing and experimentation to obtain actual heater temperature readings, here is how the heater functions.

Monaco installed a simple snap disk thermostat, hanging from the attic of the wet bay or the utility bay. This thermostat will turn ON around 35 d F and OFF around 45 d F. Not the most expensive control....but probably adequate.

The Cargo Heater has a Positive (Hot), a Trigger (Thermostat) signal, and a ground. When the Snap Disk thermostat comes on, it sends a 12 VDC signal to the "Trigger" line. It also activates the System Heat Pilot Light in the coach interior. The Cargo Heater is actually powered from a fused circuit and an onboard (internal) PCB Controller regulates the heat.

Once the Snap Disk has closed, the Trigger signal is now powered. The Cargo Heater's internal PCB will start the fan and after a small 1-2 second delay, the heater will then be powered. The unit quickly builds up heat and will then cycle the heating elements to maintain in internal air temperature of between 40-50 d C at the heating block.

The thermal fuse is crimped to the electrical connection on the heating block and because it is directly connected to heater, it runs at a much higher temperature. After the FIRST "ON" cycle, the temperature at the thermal fuse cycles between 55 – 95 d C. BUT, under certain operating conditions (cold start in a confined space) that first start-up or ON CYLCE can produce temperatures that will approach 135 d C. OPPS....the thermal protection fuse or Single Shot is rated at 121 d C.

SO, the Cargo Heater is most apt to fail on an initial startup. There is a rather robust aluminum frame housing the heating elements and also 4 thicknesses of screen wire (presumably heated so that forced air will heat quickly and also be evenly distributed from the screened wire). This initial ON Cycle heating requires a longer cycle and the internal or onboard temperature regulator (mounted on the aluminum frame) has to reach operating temperature.....THEN it cycles and maintains the 55 d C – 95 d C operating range at the thermal fuse location. When the regulator shuts off the heater elements, the circulation fan, controlled by the PCB will continue to run to prevent overheating.

Based on our data , the 121 d C Single Shot is really inadequate and the failure rates attest to that. It also makes the units very unreliable as the System Heat Pilot Light is ON....so one thinks..."All Is Well"....but it does NOT measure the actual temperature of the utility bay.

A secondary or auxiliary Remote Temperature Sensor is recommended. These are commonly called "weather stations" and have an internal monitor and a remote (wireless) sensor. Therefore you actually KNOW what is going on in the bay.

We believe that the Single Shot was poorly designed and was not tested in simulated utility bays....which is the primary end usage. Frank McElroy, a research scientist prior to retirement, set up a simulated cargo bay (in a 45 d F building) and ran a variety of tests with thermal couples at various locations inside the heater to record the operating temperatures described above....as well as retesting to verify data. Bottom line, the normal operation of the heater with the "New" Single Shot should have a high failure rate.....and that, based on feedback, is the case.

After reviewing the data, we both came to an independent conclusion....the Single Shot thermal fuse needs to be replaced with a higher temperature fuse....In addition, a 20 Amp thermal fuse would probably be more reliable as the current could approach 15 amps....especially with a poor crimp.

NOW....how HIGH? Logic would dictate that if the Engineer chose 121 d C with an operating max of around 95 d C (we do NOT think that he actually measured the temperature of the first ON Cycle....which is what is causing the failures), then you would add about 25 – 30%. That is well within reason for a "Safety Factor". Given that, then you would need around 40 d C for the safety factor on the first "On Cycle". That would be in the 165 - 175 dF range.

THE FIX

Frank did a lot of internet searching and found a 20 Amp 184 d C Thermal Cut Off Fuse and Crimping Sleeves from Newark Electronics.

- *Thermal Cut Off Fuse Newark PN 39T4439 (Thermodisc G5A01184C); \$1.92.*
- *Crimp Sleeve Newark PN 50F3313 (TE Amp 323754); \$1.20 for 2*

The included pictures show how to properly install and crimp the replacement. There was a lot of work that went into finding the proper crimp sleeve. A ratcheting style crimper was used...but if you had enough leverage, then Linesman's Pliers might suffice. A good, high pressure crimp is needed to provide proper current carrying capacity and also not overheat the fuse leads.

NOTE the polarity or the Color Indicator in the photos. Make sure that you install it THIS WAY.

The pictures show the Fuse without trimming the leads. Trim as needed, shorter the better. BUT, BE CAREFUL that the exposed leads do NOT touch any metal or such in the heater.

Go to the Photos at the end if you are not interested in the Final Technical Discussion below.

Some have suggested TWO of the RS 10 Amp Overloads so that you have an effective 20 Amp draw. Yes, that MIGHT work....but the temperature is 225 d C or about on third HIGHER than our best "guess" and almost DOUBLE the original Single Shot.

Others have suggested going back to the original design and removal of the Thermal Overload or Failsafe. We have NO knowledge of what prompted the addition of the Single Shot....but conjecture might say that a PCB went "WILD" (Run-A-Way) and the heater caused damage or perhaps was a melted mass of plastic. Usually Engineers do not ADD components to tried and proven circuits....UNLESS there is cause for concern....(Dare I mention Norcold to illustrate my point?).

Again....each person has to determine IF they want to repair the heater and IF SO, what solution works for them and their family's safety.

Tom Cherry and Frank McElroy



